THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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THE

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ELECTRICITY IN THE PRINTING TRADES.

THE Printing, Stationery and Allied Trades Exhibition now being held in the Agricultural Hall, Islington, whilst it cannot—owing to its very temporary nature—show to the full the advantages of the electric drive, must impress the visitor, and still more the exhibitor, with the extraordinary convenience of electric driving.

Machines of all kinds used in the printing trades, from rotary and flat-bed printing machines down to stitching and perforating machines, are on view, and, with few exceptions, all are shown in actual operation under proper working conditions by reason of the adaptability of the electric motor. Whilst not impossible, such a result would be almost impracticable by any other means. With the electric drive the power can be brought to the machine quite regardless of its position, whereas with the mechanical method of driving the position of the machine must, to a large extent, be determined by the position of the shafting.

In this issue we deal specially with the applications of electricity in the printing trades, and the descriptions of installations in well-known printing offices, together with special articles on the use of electricity in the printing office, will, we hope, not only be of interest to our regular readers, but will be read with profit by printers, more especially by those whose works are not yet electrified.

The convenience of the electric drive in the printing office must, we think, be generally admitted, as also must its comparative cleanliness when compared with the method of driving by overhead shafting, pulleys and belting; its economy and its possibilities as regards increased output are matters to which the test of experience must be applied.

One of the safest guides in these matters is the attitude of those printers who have given electric driving a fair trial, and it is our experience that no sooner has a printer realised the advantages of the electric drive by installing one complete motor equipment, than he feels he must have a motor on this and that machine, so that he can run it after the usual hours without the necessity of running the whole place. If you ask him if electricity is economical in cost of power he probably does not know; but he does know that the convenience far outweighs all other considerations. And, of course, from the point of view of economy, the running of one or two isolated machines cannot effect any saving in running costs, because the engine and shafting losses remain practically unchanged until it is possible to shut down some portion of the shafting entirely. There is, however, ample evidence from those firms who have gone in entirely for electric driving, as to the economy of power, the better and more uniform quality of work, and the increased output per machine.

The driving of the presses is only one part of the work of a printing office, and electricity will be found to possess unequalled advantages for lifting and transporting the raw and finished material. The lift or elevator is one of the most valuable adjuncts to the printing office, and the economy of

electric cranes and lifts, as compared with hydraulic, is so marked that it is sometimes advisable to understate the case lest a customer should think it too good to be true. There is, however, ample evidence from absolutely disinterested sources, which fully bears out the claims made for the electric lift.

As regards lighting, it speaks well for the convenience, cleanliness and other advantages of the electric incandescent lamp that it has more than held its ground against its great rival, high-pressure gas. At one time it looked as if the latter would become popular in the printing office, in spite of its dirt, heat and other disadvantages; but the advent of the metal-filament lamp took place just at the psychological moment, and gas received its final set-back as a printing-office illuminant. For general lighting, the arc lamp, both of the enclosed and the reflected-light type, still finds a useful field for employment, supplemented by metal-filament lamps for individual machine lighting, whilst the mercury vapour light has recently made some headway for the lighting of composing rooms where the colour is not a serious disadvantage; but its most important field at present in connection with printing applications is in photography and photo engraving, for which it possesses unique advantages. There is, in fact, no department of printing in which electricity cannot be employed with advantage, be it for power, lighting, heating, ventilating or transporting, and the wisest printer is he who takes fullest advantage of its immense possibilities.

THE I.E.E. COUNCIL ELECTION.

The result of the ballot for five seats on the Council of the Institution of Electrical Engineers, contrary to our expectation, was in favour of the West Country nominee—in spite of the manner in which his candidature was supported—and Mr. Kingsbury, the candidate selected for attack, was defeated. Throughout the course of the discussion on this subject we have refrained from criticism or comment regarding the comparative personal merits of the respective candidates; the question at issue, as we understood it, and as the authors of the circular declared, related to the adequate or inadequate representation of the West of England and South Wales district on the Council, and was not affected by the personal qualifications of the candidates as Councillors. We may, therefore, be permitted to join with the defeated candidate in congratulating Mr. Faraday Proctor on his election to the Council, without prejudice to the consideration of the broad principles involved in the conduct of the election.

In our "Correspondence" columns to-day we are severely taken to task by a correspondent in South Wales, who accuses us of partiality, unfairness and abuse, in connection with our recent comments on the election. The spoils are to the victor, and we do not grudge our correspondent the pleasure he derives from chanting a pæan, or, in colloquial phrase, "rubbing it in"; but we fail to see in what respect we have been guilty of the crimes alleged against us. We endeavoured to preserve a judicial attitude, and to confine our comments purely to the merits of the question; we raised no objection to the issue of a circular, though we could not refrain from condemning the lack of taste and good feeling which its contents evinced. We have since been gratified by many expressions of approval and support of our attitude, which we do not modify in the slightest degree.

But what were the facts about the election? On what grounds does our correspondent base his claim "that the members of the Institution were completely in agreement with the suggestions put forward"? We have ascertained from the Institution that the results were as follows:—

Mr. MacMahon, 854; Mr. Pearce, 852; Mr. Dickinson, 846; Mr. Morcom, 842; Mr. Proctor, 696; Mr. Kingsbury, 438.

About 3,370 voting papers were sent out, and fewer than 1,000, we believe, were returned (the precise figure is not available). It is not possible to determine from the foregoing figures exactly how the votes were allotted, but it is certain that not more than 21 per cent. of the electorate recorded their votes in favour of Mr. Chamen's nominee. How many of these took that step from a sincere conviction that the election of the latter would make for the best interests of the Institution, and how many did so merely with a vague idea of having a dig at the Council, like the Irishman who was "agin the Government" on principle, we cannot tell; but to claim that the result is the verdict of "the majority of members throughout the country," on the strength of the votes of one-fifth of the whole number is clearly absurd.

No one knows, or will ever know, what the majority of the members think about the matter; we have a suspicion that most of them did not trouble to think about it at all, but that is by the way—it merely illustrates our comments on elections in general in our last issue.

We have no interest in the matter beyond a sincere wish for the prosperity of the Institution, and our action has been founded entirely upon that basis. We shall look forward with interest to the developments which may be expected to take place in connection with the electrical industry in the West of England and South Wales in the near future.

Electrically-Driven Printing Machinery.

The pre-eminent convenience and economy of the electrical drive and the extraordinarily wide scope of its applications, are well exemplified in the article which we print elsewhere in this issue, on the electrical equipment of Messrs. Edward Lloyd's extensive premises, which, during the past few years, have been completely reorganised under the supervision of the chief mechanical superintendent, Mr. Mascord. It is interesting to note that the alterations were carried out without disturbing the regular issue of the various journals printed by the firm.

In response to our inquiry as to the relative commercial advantages gained by the adoption of electrical methods throughout the establishment, Mr. Mascord informed us that the conditions all round were now so different that no fair comparison was possible with the steam-operated and gas-lighted period. He could only say that in one section alone where it was necessary to put down an electric motor temporarily, it was found that 40 per cent. of the power required was used for running the 5-in. main shaft and cogged bevel gears, and as that section had been running for many years, it gave some idea of the losses that had been incurred during that period.

In place of the main shaft drive, one 60-H.P. and five 40-H.P. direct-coupled sets were used in addition to various smaller ones, and four printing presses now occupied the site of a pair of engines and two boilers. As for the lighting, —well, comparison, he thought, was out of the question!

One remarkable thing, however, was that metallic-filament lamps had not effected the saving anticipated, the breakages practically offsetting the saving in energy. This, Mr. Mascord considers, must arise from the general tremor of the

building, and though it may, he thinks, appear paradoxical, the very rigidity of the walls and fabric may possibly be the real cause of the trouble, in that the vibrations are shorter and more abrupt. In a building where greater elasticity existed, the probability is that the lamps would stand better. Many different kinds of lamps are in use, and have been used, all with like results. The circumstances are unique in our experience, and we should think that the trouble could be overcome; no doubt the tungsten drawn-wire lamps that we are promised will solve the difficulty.

The energy annually consumed by Messrs. Lloyd amounts to about 756,000 H.P.-hours; to produce a single issue of *Lloyd's Weekly News*, the consumption is 4,000 H.P.-hours, or say 3,500 units. If we assume, for convenience, that the issue consists of 1,400,000 copies, it results that with one unit of energy no fewer than 400 copies of a large weekly journal are printed!

We understand that the proprietary will be pleased to show the plant during working hours, and that, for the general convenience of visitors who may not desire to stay up all night, Saturday evenings, from 8 to 11, are most suitable.

Electrical Authorities and the Law of Negligence.

A CASE which was heard last week by Mr. Justice Grantham and a jury, and is reported on another page of this issue, draws attention to the serious liabilities imposed upon electrical companies who allow live wires to remain in disused premises. The facts may be very briefly stated. It appeared that the plaintiff was a builder and contractor, and was, in April, 1909, engaged in rebuilding a house, 32, Devonshire Place. In the course of his work he cut with a chisel into a piece of lead piping in a cellar, which was, according to his evidence, hanging down from the ceiling, and which he took to be a gas or water pipe. It was, in fact, a live electric cable, which had been left by the defendants when they disconnected the consumer's installation some time previously. The result was a severe shock and burning, and it was alleged that the plaintiff was completely incapacitated for over six months, and permanent injury had been caused. The defendants maintained that the cable had been properly disconnected by withdrawing the fuses of the cut-outs and removing the leads connecting the cut-outs with the installation, the cut-outs being properly sealed up and insulated, and the cable attached by wall hooks to the wall. They claimed that the cable was their own property, with which the plaintiff had no business to tamper; but it was maintained for the plaintiff that, having received orders to disconnect the service, the defendants had no right to keep a live wire on the premises. The defendants alleged negligence on the plaintiff's part, as the presence of the cable and sealed cut-outs should have given him warning of possible danger, but the plaintiff said that he did not see the sealed cut-outs, as they were hidden under some rubbish. It appeared that the plaintiff's foreman had told the defendants' engineer, before the disconnection took place, that, though the house was coming down, the cellar was not going to be touched, and that it was in consequence of this that the live wire was left on the premises. After hearing the case the jury found a verdict for the plaintiff, and assessed the damages at £450 for loss of business, £75 for pain and suffering, and £56 for special damages.

This apparently amounts to a decision that if a supply authority have received orders to disconnect any premises, they may not leave any live wires on the premises; or that, if they do so, they do so at their own risk.

Some Reasons Why.

ALL sorts of reasons have been advanced for the smallness of the volume of British electrical exports to Canada. We welcome every new study of the situation that is made by those interested in the expansion of British electrical trade, though we cannot but feel regret that the advice given as the result of many earlier investigations has not been acted upon more zealously. Sometimes it even happens that the electrical Press is blamed for not giving sufficient attention to the market—we at least may claim exemption from such a charge. Canadians advise us that British electrical manufactures are every bit as good as, or better than, others, though our manner of serving them up is not right; both in the goods themselves and in the form in which we sell them, they need more adaptation to the market. This has been brought home to British firms again and again with the urgent suggestions that they should study the peculiar requirements of each market separately and then contrive to meet them. In our "Correspondence" columns to-day, these questions are again usefully discussed by a correspondent signing "Export." We hope that this contribution, which confirms what we had already heard and said several times, will be seriously taken to heart. Our manufacturers and traders might also profitably read the strictures passed upon British firms by our Consul at Mozambique, which we also publish in this issue.

Telephone Administration.

A REVIVAL of interest in municipal telephones is indicated by a discussion at the twelfth annual conference of the National Chamber of Trade, at Bradford, on the 28th ult. In the annual report it was stated that "it had recently come to the knowledge" of the Chamber's Telephone Committee that the average cost per station throughout the National Telephone Co.'s system was £30; of the Post Office in the local area, £52; and in the area of the municipal exchange at Hull, £21. One of the speakers said that, if the Government could not manage a local service better than they now managed the trunk service, they ought not to retain it in their own hands. He added that the traders of Hull had saved £16,000 a year in the amount they had paid for their telephones.

The alleged saving might vanish on close examination. At any rate, the existence of a duplicate though intercommunicating service is not conducive either to economy or efficiency.

In the near future, considerable discussion may be expected on the telephone question, and the revival of the municipal idea will doubtless take its share. It may be well, therefore, to suggest that the figures quoted do not go "to the root of" the matter, as indicated in the Chamber's report. Municipal telephones have been tried and found lamentably wanting, both in principle and practice. The telephone service requires unity in control and operation. Under municipal management, it can obtain neither. Chambers of Trade and Commerce who take up this subject for discussion will be well advised to consider the question of extension and development, rather than dwelling unduly on the comparatively trifling matter of cost. There is ample evidence that the public are ready to pay a fair price for good service. To haggle over pence is to obscure a very much wider and more important issue. Development is the need. The development must come from a central source. The policy now settled is that the Government shall be the central source, though opinions are expressed that, for its due progress, it needs the incentive of private enterprise.

The Caxton Hall Debate.

WE conclude on another page our report of the first night's debate on Free Trade and Protection and the Electrical Industry. It is not our intention to comment on the matter here; we only desire now, on behalf of the secretary of the National Electrical Manufacturers' Association, to remind all interested in electrical affairs that the discussion will be resumed on Monday next at the same place at 8 p.m. A large attendance and an interesting debate are anticipated.

E

ELECTRICITY IN THE PRINTING OFFICE.

By FRANK BROADBENT, M.I.E.E.

The economical advantages of electrical driving are nowhere more manifest than in the printing office. I do not know of a single case where a printer has reverted to the old method of driving after having once introduced electricity into his works. On the other hand, the advantages and convenience of the electric drive are such that when a printer has once experienced them, say, by driving one or two isolated machines, he invariable extends the system until his whole office is electrified.

The advantages of electric driving consist not only in economy in power costs, but electricity pays in many other directions. The cost of power in the printing office, important as it is, is not always the most important item. Among the other advantages are the increased output from the machines, the better quality of work produced, and the perfect and individual control of the machines.

Where electricity is not used, a very common method of driving printing offices is by means of a gas engine driving through shafting and belting; the machines are connected to the line shafts by means of the ordinary fast and loose pulleys, being started and stopped by means of the striking gear on the machines. In such a method as this, there is no doubt at all, as I have proved by repeated tests, that at least half the gas consumed in the gas engine is used solely for driving the shafting and belting; that is to say, if the gas engine were run for a definite period without any of the printing machines running at all, the consumption of gas would be fully half the total quantity used when the machines were working in the normal way.

By individual electric driving, this constant loss is entirely eliminated. Moreover, when a machine is driven, as it often is, through a series of several shafts and belts, the variation of speed on the shaft which actually drives the machine is generally not less than about 15 per cent., a fact which very materially affects the output from the machine. I have in mind a case in which two machines, namely, a two-revolution Furnival and a Cottreell, were each taken off the line-shaft, drive and equipped with electric motors. These machines turned out a regular class of work, printing one of the high-class weekly illustrated papers, and the average nightly output—for the printing was done during the night—was accurately known. The machine speed was nominally 1,670 I.P.H., which was as fast as it was possible to turn out good work with the line-shaft drive. The speed of the electric motor was adjusted to give as nearly as possible the same output, that is to say, 1,670 I.P.H. It was found, however, that the output of the electrically-driven machines was at least 10 per cent. greater for each night's work than had hitherto been the case on the line-shaft drive, and greater by this per cent. than the output of identical machines which were supposed to be running at an identical speed.

This increase is accounted for solely by the fact that the drive from an electric motor is practically constant and uniform, whereas such a thing as constancy and uniformity of speed is a practically impossible condition when driving from either a steam or gas engine through several lines of shafting and belting.

Another point which may have a bearing on the increased output, is that an electric motor as it warms up to its work gradually and imperceptibly increases in speed to the extent of, perhaps, 5 per cent. in the course of a day's work, so that at the end of the day it will be generally found that the motor is running slightly faster than at the beginning.

There is another feature of the individual electric drive which has also an important bearing on the output of a printing machine; by means of the speed regulator the speed of the machine can be varied in very small steps, and not in two or three jumps, as is the case when running through the usual cone pulleys and belts. The effect of this is that the machine can be run at the maximum speed suited to the particular job in hand, and it is the fact that, owing to the regularity of the drive, machine speeds can be set higher when driven by electricity than when driven by the ordinary mechanical methods, the result being that, on machines doing a variable class of work, the output, over a period of 12 months, may be increased by as much as 25 per cent.

This is a point which a printer should not overlook in considering the relative merits of electrical and mechanical driving, and he should not be guided entirely by the comparative costs of electricity and the costs of coal and gas. In a small printing office, using, say, a dozen machines, it is not always possible, notwithstanding the very great losses from shafting and belting, to show that the actual cost of electricity will be less than the present gas or coal bill; but when the printer considers that his existing 12 machines when individually driven by electric motors arranged to give the most economical speed control, will turn out as much work, say, as 15 machines on the old system, he will appreciate that the cost of driving is not the only nor even the most important consideration. In effect, electrical driving under these conditions practically makes him a present of the output of three new machines without his incurring any additional capital cost for new machines and practically without any additional labour charges.

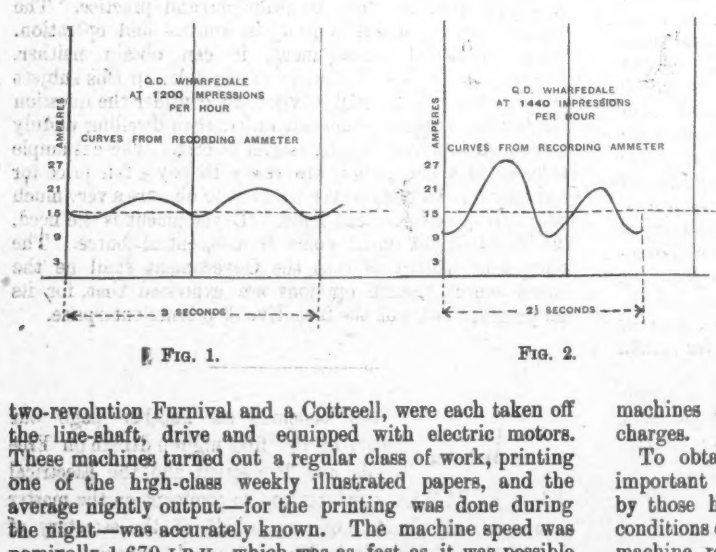


Fig. 1.

Fig. 2.

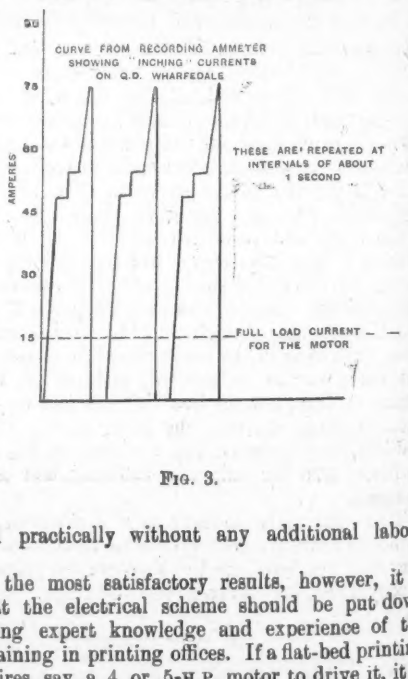


Fig. 3.

To obtain the most satisfactory results, however, it is important that the electrical scheme should be put down by those having expert knowledge and experience of the conditions obtaining in printing offices. If a flat-bed printing machine requires, say, a 4 or 5-H.P. motor to drive it, it is not sufficient simply to buy over the counter, so to speak, a 4 or 5-H.P. motor with an ordinary starting switch to suit. A printing machine does not take a regular draught of power, but, on the contrary, demands a very fluctuating power, the character of the power curve depending not only upon the type of machine, but also upon the speed at which it runs. Running

at a moderate speed, the power curve of a flat-bed machine resembles very much an indicator diagram from a steam engine. The curve shown in fig. 1 was taken by the writer with a recording ammeter, and shows the varying power taken by a flat-bed letterpress machine when running at a speed of 1,200 I.P.H. Fig. 2 shows a power curve from the same machine when running at a higher speed, namely, 1,440 I P.H. It will be noticed that the power peaks are sharper in the second than in the first curve, owing to the extra power required to reverse the bed when running at the higher speed. In the case of a litho machine the power curve is somewhat more uniform, due partly to the lower speeds at which litho machines are run as compared with letterpress machines, and partly also to the weight of the stone. To deal satisfactorily with a fluctuating load of this character the motor should be specially wound for the purpose. On the other hand, if a standard motor should be used its rating would have to be somewhat higher and its consumption of electricity might be anything up to 10 per cent. more than would be taken by a motor wound specially to suit the machine.

No hard and fast line can be laid down as to the method of connecting a motor to a printing machine, as a great deal depends upon the general arrangement of the machine and the position of the driving shaft. For Wharfedale machines, where the shaft is at the end of the frame, the most convenient method is to drive the machine from the motor through spur gearing, the motor bed being bolted up to the machine frame in such a way as to keep the gears properly in mesh. With a raw-hide or paper pinion on the motor spindle a fairly silent drive can be obtained with a suitably proportioned gearing. Somewhat higher gear

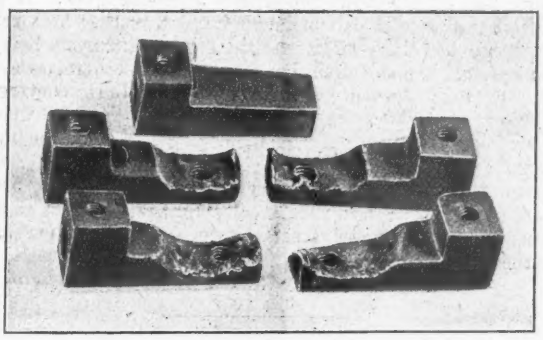


Fig. 4.—Burnt Controller Contacts.

ratios may be obtained by the use of double helical gear wheels, and these run silently if they are accurately adjusted, but may be very noisy if sufficient care is not taken in this connection.

Machines having their driving shafts somewhere near the centre of the frame, such, for instance, as the Miehle, Cotterell, Century and Huber machines, lend themselves better to belt driving, the motor being placed either under the feeder board, or under the ink duct as may be most convenient. The belt in this case runs underneath the machinist's platform, and does not, therefore, take up useful space, as is the case with a belt-driven Wharfedale machine.

Modern machines, owing to the extra rolling power now used, take more power than earlier machines of the same make. As an example of this, I have several old Middleton Perfectors running comfortably with a 4-H.P. motor each, whereas a modern Huber Perfector, printing the same size forme, would require three times the power. This extra power is, no doubt, largely due to the fact that the mechanism provides for varying the speed of travel of the bed, and as the bed of this machine is a fairly heavy mass, the power required to accelerate it is considerable. Machine makers probably do not attach much importance to the power taken by their machines, but it makes a great difference to the annual running costs, and when this running cost is capitalised, it may even result in what appears to be a cheap machine being a particularly expensive one.

Switchgear.—Important as it is to obtain a motor specially suited to printing press driving, equally important is it that the switchgear should receive special consideration. It is not too much to say that the ordinary starting switch used for starting a motor up once or twice a day on a line shaft is absolutely useless on a printing machine individually driven by motor. In making ready, a switch may be operated 100 times a day or more. This may seem an exaggeration, but when we remember that in inching a machine, in order to get the forme in the right place, the switch may be struck on or off a dozen times in a few seconds, it is easily appreciated that 100 times is not at all an excessive estimate of the number of times a switch may be struck on and off in the course of a day. The recorder diagram, fig. 3, shows the excessive currents taken when inching a machine by a hand starter, and fig. 4 gives a view of some contacts taken from a starter used in this way for a few months. The ordinary starting switch is not constructed to stand treatment of this kind, and it is essential that to meet such exceptional conditions switches specially designed for the purpose should be used. "Inching" is, of course, just as severe on the motor as on the starter. The tendency nowadays is to use automatic switchgear for machines, say, of 5 H.P. and upwards, and no doubt as the demand for this type of switchgear increases, and the price is correspondingly reduced, it will be the regular practice for machines of even smaller powers. This absolutely prevents the condition of things shown in fig. 3.

By the use of automatic switchgear not only has the machinist a better and more convenient control of the machine, but the strains on the motor and the machine itself are considerably reduced. In striking on a machine by the ordinary hand switch it is possible to throw upon the motor many times its normal current, which not only tends to cause sparking but also throws excessive strains on the motor and on the printing machine.

By means of automatic switchgear, the current is put on the machine gradually and abnormal strains are avoided.

It is not perhaps generally recognised that driving by means of fast and loose pulleys from a motor throws greater strains on the motor than would be the case with a direct drive and automatic switchgear. When a motor is running at its full speed, and the layer-on throws the belt striker hard over, the motor takes an excessive load in its attempt to start up and accelerate the machine more rapidly than the inertia of the moving parts will permit. Only the other day I confirmed this on a No. 1 Huber machine, which was driven from a motor through fast and loose pulleys. I asked the machine minder to strike on in the ordinary way whilst I watched the ammeter needle. The current rose to a value representing 18 H.P. whilst accelerating the machine. I then stopped the motor whilst the belt was on the fast pulley, and started it up again by the switch, when the current did not reach a value representing more than 10 H.P. In inching the machine therefore by the belt striker it is obvious that the motor was subjected to rapid and intermittent strains corresponding to 15 or 18 H.P. The slipping and squeaking of the belts indicate the excessive power taken even when not driven by motor.

Grouping of Machines.—A great deal has been said on the question of grouping, but no definite rule can be laid down as a guide. Whilst it appears to be the general view that all machines requiring, say, less than 2 H.P. should be grouped on a line shaft, there are cases when it would be better to drive individually smaller machines even than this. Under some conditions even stitching and sewing machines may, with advantage, be driven individually. For example, if a row of half a dozen stitchers are driven from, say, an overhead line shaft, through several shafts and belts between the actual machine and the engine or motor, it is quite probable that 2 H.P. is continually absorbed in driving shafting and belting alone, apart altogether from the actual power taken to drive the sewing machines. Reckoning the cost of a H.P. per annum of 2,600 hours as £10, which is equal to about 1d. per hour, the cost of running the shafting and belting alone is £20 per annum, representing at 10 per cent. a capital cost of £200, which would be much more than double the capital cost required to equip each machine with its own motor and regulator. It is only by considering each individual case in this way that we can

determine whether or not it pays to adopt individual driving or group driving.

I have not touched upon the question of rotary-press driving, which is a subject quite apart, and is a case in which very special conditions have to be met, conditions which can, in fact, be only properly met by individual electric driving.

THE PRINTING, STATIONERY AND ALLIED TRADES EXHIBITION.

This Exhibition which remains opens at the Agricultural Hall until the 9th inst., contains an unusually interesting collection of printing machinery, and is not without interest to the electrical engineer, seeing that practically the whole of the machinery is electrically driven.

One of the first stands to arrest the attention is that of Messrs. Harrild & Sons, who exhibit a large variety of electrically-driven machines ranging from a crown-sized "Rapid" running at 3,300 impressions per hour, to a quad-demy two-colour. The smaller machines are equipped with belted motors by Electromotors, Ltd., of Openshaw, and plain hand-operated starting switches, while the larger machines are driven by direct spur gearing from the motors which are bracketted to the end frame. Automatic switchgear of the Broadbent patent type with small master switch near the operator's stand, is employed, so that these machines show the very latest practice in electric driving. Circular saws, routers, and guillotines are also shown in operation, each fitted with its own motor.

Near by is the stand of the Linotype and Machinery Co., who have made the Miehle machine and Linotype composing machine so popular in this country. They show a number of electrically-driven machines, both flat beds and litho. rotaries. Newton motors driving by belt over a jockey pulley appears to be the favourite method, and the method of control is by drum controller placed near the operator's platform.

The Victoria Press Manufacturing Co. show several electrically-driven Victoria platens—a very popular machine, and also a quad flat bed which has several novel features. This is driven by a belted motor, the starter being operated by a brake handle from either side of the machine, through link rods. In a smaller flat bed, the starter is connected to the brake handle through a flexible steel cord.

Other stands of interest to the electrical engineer are those of Furnival, Mann, and Hoe, at each of which are shown rotary litho. presses, which, together with automatic feeders —of which there are quite a large number exhibited—form the striking feature of the Exhibition. At Messrs. Hoe's stand, the rotary press is equipped with a Kohler equipment, which is illustrated elsewhere in this issue.

Among other electrical applications are those to be seen at the stand of the Photo Engraving Co., where the arc lamp is indispensable; also at Messrs. Walker Bros'. stand where small electric motors are used for vacuum cleaners, including the ingenious invention of Mr. Fishburn for cleaning type cases, and also his forme-washing machine.

Electricity is also used in connection with the stop-motion of automatic feeders, and for driving the pneumatic apparatus for the same appliances.

Some very attractive multi-colour signs are to be seen in operation at the stand of the Ken Law Multi-colour Syndicate, the commutators for producing the various effects being driven through worm gearing from a small motor.

Brussels Exhibition.—The managers of the Exhibition inform us that a Mr. Max Kaiser, describing himself as "Commissioner for England and Great Britain," is soliciting manufacturers and traders in respect of an exhibition at Brussels, which may be mistaken for the Exposition Internationale et Universelle now in being. The forms of application for space are headed "International Exhibition, Brussels, 1910." Mr. Max Kaiser has no connection with the International Exhibition in which the British Government and the Governments of other nations are participating.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Rural Engineering.

The enclosed cutting, which has been sent to me, will no doubt find many sympathisers among your readers.

One can picture the interesting conversations on the matter which will no doubt take place between the local carpenter and the clerk. Possibly an additional interest will be lent to the proceedings by the calling-in of the village cobbler and barber as consulting advisers.

Fresh Air.

[The cutting calls for tenders, "from joiners only, for improving the ventilation at Hightown Council School, Liversedge." As a matter of fact, the efficient ventilation of buildings is a most difficult problem, rarely solved satisfactorily, even by experts.—Eds. E.R.]

The Whitehaven Colliery Disaster.

I note the remarks by "Maque" *re* the above in your current issue. I am in full agreement with him in considering a telephone installation a necessity in every mine. I, however, do not think lead-covered cable would give him good service in such a disaster as this one, where the heat was so great that it melted the solder on the smoke-helmets of the Sheffield men. By the way, "Good luck and long life to them!"

My experience is that nothing can beat galvanised-iron wire run on insulators for colliery telephone work. It is cheap in first cost and maintenance, and neither heat nor moisture has much effect on it. I have, after very heavy falls, found it undamaged, but the telephones were useless, as the rails shorted them. Where the lines converge towards the pit-bottom, cable or separately-insulated wires may be used, the insulation and covering depending on the conditions of working. Some collieries use microphones connected across the "knocker" or signalling wires, but, whilst these give, as a rule, good service, they are not to be compared to a proper separate telephone installation for either utility or convenience.

P. A. D.

A Premium on Folly.

A London builder has been awarded £525 for personal injury and loss of business resulting from a shock caused by attempting to cut a live service cable with a hammer and chisel. It appeared from the evidence that the supply authority had, in response to instructions, sealed up the cable but not removed it as the premises were not to be entirely pulled down. Whether the disused cable was labelled in any way is not stated—but the injured man, who is described as a builder in a large way of business, stated that he took the cable to be a lead pipe and proceeded to cut it down, with the result that he was severely burned, and was incapacitated for several months. Whilst sympathising with his misfortune, the reflection immediately occurs that the average workman would have to be much more careful to investigate the purpose of a pipe before attacking it, and that in the absence of instructions to remove a service any suppliers of water, gas or electricity should be protected against such careless misuse of their property which, in some cases, might have dangerous results by no means confined to the ignorant originator of the trouble.

Builders' workmen as a rule are alive to the need of care in handling cables, but in one case of a similar character which has been brought to the writer's notice, the result of attempting to tear down a sealed service box was a short circuit which destroyed a service cable, shut down a small works, and narrowly missed causing a fire in the premises involved.

It is very desirable that electric cables should be plainly labelled with a caution concerning their misuse, and that in

outward appearance they should not be easily confused with a plain lead pipe.

The judgment in the above case suggests, amongst other things, that a man whose energies are valued at £100 or more per month, has no right to expose the community to the risk of compensation claims by doing work which would probably be done better by an artisan at 9d. an hour.

B.

Manufacturers and Consumers: A Contractor's Complaint.

It has been the etiquette of the trade, or at least I have so understood, that when a manufacturing firm wishes to create a demand for its goods by approaching the consumers direct, such advertisements should not advertise the manufacturing firm itself, but only articles of their manufacture.

A circularisation regarding electric lamps emanating from a well-known firm having works in the Midlands has recently been carried out, the envelopes being printed with the full name and London address of the firm, and the stamp on the envelope being perforated with its initials.

This seems to me very unfair to the trade who surely have a sufficiently hard struggle to make both ends meet, and surely it is a little hard that even electric lamp firms should try to cut the ground from beneath the feet of the contractor.

Fair Play.

The I.E.E. Election of Council.

Now that the election of Mr. Faraday Proctor to the Council of the Institution of Electrical Engineers is an accomplished fact, it will, perhaps, be admitted that the views held by the members who nominated that gentleman, and who worked to secure his election, must have been entirely in accord with the views of not only their fellow-members in the West of England and South Wales, but the majority of members throughout the country.

It would also seem that the members of the Institution were completely in agreement with the suggestions put forward by "the select and apparently self-elected coterie of gentlemen in the West." Now it is quite understandable that in every large and important Society there must be a few whose intelligence cannot be rated very highly; and as abuse is always the refuge of the destitute in intelligence and argumentative powers, the effusions in your "Correspondence" columns can be taken at their true value. But what is not so easy to understand is why you—who should know the difference between right and wrong—strayed from your impartial path in order to condemn and abuse the action of those members who, in the face of long odds against them, did what they thought was best in the interests of the Institution, and whose action has, as must be admitted, received the support and approval of its members.

I sincerely trust that further criticism may be made in a better spirit, and in a fairer manner.

Theodore Schonthell.

Cardiff, *May 30th*, 1910.

[We refer to this matter in our leading columns to-day.—Eds. E.R.]

Canadian Trade.

The writer, who would prefer to remain anonymous, has been endeavouring to get at the bottom of why (in his opinion) we do not do as much trade with Canada as we ought to do, and he accordingly got into close touch with one of the principal Canadian firms.

He has a letter from this firm stating that they are quite willing to concede that in many respects our manufactures are ahead of American manufactures, but giving the following reasons:—

"Now from foregoing you reasonably wonder why we do not jump at British manufactures.

"1. In the past when German surtax was on in Canada, we made some purchases of ostensibly British goods, which the Customs claimed (and we now feel they were right), were merely German goods relabelled, and we were mulcted a surtax of duty thereon, instead of a preferential.

"2. In flexible cords, the custom here is 50-yard or 100-yard coils. In a purchase from another house although this was mentioned, they shipped in 72-yard coils, informing us that they thought we would have no difficulty in 'educating' our people differently.

N.B.—We have neither the inclination nor the time to start an educational institution.

"3. A shipment ordered per sample (this is from a presumably reputable London house) was filled with a substitute, which the firm afterwards admitted, because, as they said, the goods found favour in India they thought they should in Canada. In this case we returned the goods to London.

"4. Our architects get their education by running across the line into the U.S.A., and, on return, specify the fittings, &c., which they have seen there. Naturally, we must supply them.

"5. A shipment ordered by us in February was received by us in October, a fairly decent time—we think you will admit—to wait, when a U.S.A. shipment could be to hand in a couple of days.

"6. The contractor element has to be taken into consideration, he asks for specific goods.

You will, therefore, see that we have not in the first place had gigantic satisfaction, and in the second, are handicapped by requirements."

Export.

"Merry Devil."

Why is it that the so-called "Dr. Bodie, M.D.," is allowed to go about from town to town absolutely "swanking" (if I may use the term) electricians out of their birthright before the public eyes, when a combination of half-a-dozen electrical men in any town in which he may appear could easily expose his "bogie show?" Is it because they are afraid of him?

Onlooker.

OUR LEGAL QUERY COLUMN.

[Questions addressed to this column should be written on one side of the paper only.]

"Kent House" writes:—"I should esteem it a favour if you would explain in your 'Legal Query' column the meaning of the words italicised in the following clause:—

"The costs of and incidental to the reference and award respectively shall be in the discretion of the arbitrator, who may determine the amount thereof, or *direct the same to be taxed as between solicitor and client or as between party and party*, and shall direct by whom and to whom and in what manner the same shall be borne and paid."

*** The words above referred to draw attention to two scales of costs, according to one or other of which the arbitrator is empowered to order a taxation. In arbitration, as in other forms of litigation, the successful party who is awarded "costs" hardly ever gets a complete indemnity; but if he is awarded costs "as between solicitor and client," he gets very much more than he gets if an order is made for "party and party" costs. It may be added that "party and party" costs are usually ordered. In taxing a bill of costs on this basis, the taxing master may allow all such costs, charges and expenses, as shall appear to him to have been necessary or proper for the attainment of justice or for defending the rights of any party; but, save as against the party who incurred the same, no costs shall be allowed which appear to the taxing master to have been incurred or increased through over-caution, negligence or mistake, or by payment of special fees to counsel, or special charges or expenses to witnesses or other persons, or by other unusual expenses. Any charges merely for conducting litigation more conveniently may be called luxuries, and must be paid by the party incurring them.

If an order is made for costs "as between solicitor and client," the taxing master is allowed a somewhat freer hand.

Holidays on the Continent.—We are reminded that the holiday months are upon us, by the receipt of the Great Eastern Railway Co.'s charming sixpenny "Tourist Guide to the Continent," from 30, Fleet Street, E.C. Some interesting views and handy maps accompany entertaining notes on a number of new tours *via* Holland, in North and South Germany, and in Belgium. A vocabulary in English, French and German is now included.

PROCEEDINGS OF INSTITUTIONS.

Localisation of Faults on Underground Mains.

By W. A. TOPPIN, A.M.I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS *at Glasgow, April*, 1910.)

THE following remarks on the localisation of faults are the result of the author's practical experience with a three-wire direct-current system, using single conductors, the distributors generally being laid solid in bitumen and the feeders drawn into conduits.

The most fruitful source of trouble on such a system is that arising from earth leakages, which may occur on either of the outer conductors or on the middle wire. As a rule these faults develop

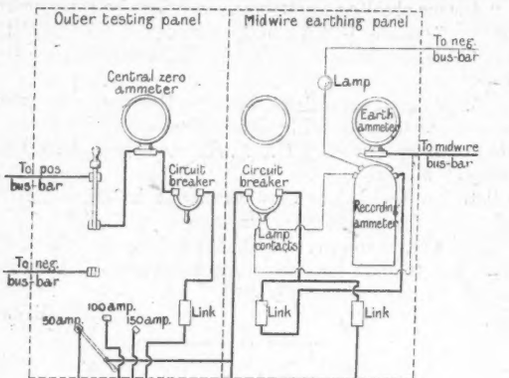


FIG. 1.

gradually, and unless localised at an early stage may result in a serious "burn-out" with possible interruption to the supply system. It is therefore wise to take steps to localise and repair a leakage immediately it begins to indicate on the earth-recording ammeter. Some station engineers believe in allowing earth leakages to develop to a more pronounced stage before adopting remedial measures; but as the primary consideration is reliability of supply, incipient main faults should not be permitted to develop to such an extent as will interfere with the supply even to a single consumer. The author's experience shows that 90 per cent. of mains faults originate in earth leakages, and these can nearly always be located and remedied before reaching the critical stage.

Fig. 1 shows a testing and earthing panel, the latter designed to meet the Board of Trade requirements. On the right-hand panel the middle wire bus-bar of the station switchboard is connected through the indicating and recording ammeters, and thence through an automatic circuit breaker to an earth-plate of ample dimensions. The cut-out is adjusted so that when the current flowing through it to earth exceeds 25 amperes the circuit is interrupted and the current is shunted through a 10-ohm resistance. When open, the circuit breaker arm closes a circuit through an indicating lamp and a relay on the recording ammeter, the latter actuating a needle to record the time during which the cut-out is open. The left-hand panel has been designed for testing the insulation resistance of the outer conductors, the method being to earth each outer cable in turn through a known resistance, noting the resultant current. It is also used to burn out minor earths which may occur on consumers' premises. If, for example, such a leakage is indicated on the negative outer, the procedure is first to disconnect the middle wire from earth and then to earth the positive bus-bar, and by passing a current which can be varied by the regulating switch, the fault is burnt clear or localised by the melting of the consumers' fuses. In an industrial district where large power users are connected to the supply mains, and especially in places like shipyards and foundries where temporary circuits are often run, many troublesome earth leakages occur, and a careful study of the earth chart will enable the mains engineer, with a knowledge of local conditions, to locate most of these faults. Overhead travelling cranes with bare trolley wires are responsible for many intermittent leakages. A record of the faults which have come under the author's notice during the last few years shows that fully 80 per cent. of the earths on a supply system occurred on the negative side. In almost every case of breakdown in a negative conductor, the core was found saturated with moisture for 4 or 5 ft. on each side of the fault, due apparently to osmotic action, while the bitumen covering, which under normal conditions is unaffected by moisture, is converted into a spongy state, quite independent of its temperature. This peculiar effect is produced on the negative cable only, and in cases of faults affecting both the other conductors, the positive core was found to be quite dry, while the surrounding bitumen was in its normal state, or only affected by the heat generated by the leakage current. A positive earth fault on a feeder cable, which occurred in a draw-in box, due obviously to a crack in the bitumen sheathing, showed a gradually increasing leakage current for a period of three weeks, and on cutting out the faulty section the moisture appeared to only have crept for a few inches along the core on each side of the fault, while the bitumen was practically unaffected.

The localisation of faults is rendered easy where cable networks are divided into sections with disconnecting links in convenient pillars. The proper method is to fuse each distributor cable at its feeder pillar, and in the event of a short-circuit the faulty section is automatically isolated from the system. Momentary short-circuits which disturb the pressure are not of great enough duration to melt the fuses, and are, consequently, the most difficult to deal with. For this reason, among others, the author is of opinion that all feeders should be provided with ammeters on each conductor. A defect on the middle wire is not easy to locate, and introduces complications when an earth takes place on an outer, as most of the leakage current from the latter may be passing to the middle wire, and only a slight indication be given of the fault.

The author proposes to describe a simple method which he has found of service, in localising earth leakages without interrupting the supply. He is not aware if the idea is novel or otherwise, but can testify from actual experience of its worth, and the chief claims he puts forward are its simplicity in operation and the absolute certainty of the results obtained by its use. Its operation depends on the fact that when an earth leakage occurs, the earth in its vicinity is charged to a potential above normal earth potential, and this potential will vary at any point in inverse proportion to the distance from the fault. Assume an earth leakage at E on a 250-volt three-wire system of distributors (fig. 2), the current shown on the ammeter with the 10-ohm limiting resistance in circuit being 10 amperes through the fault. This gives a total resistance between the fault and the earth-plate of 15 ohms and a difference of potential of 150 volts. This pressure will be highest immediately at the fault, and will diminish with the distance from the fault. It can be measured by an ordinary voltmeter, but in most cases a special voltmeter calibrated to read down to very small pressures is desirable. One terminal of the voltmeter is connected to a rubbing contact, and the other to a good earth connection, such as a steel rod pushed into the ground at a distance of two or three yards from the cable route. A light carrier, to which two steel brushes are attached, so as to make a continuous contact with the surface of the earth, is pushed over the ground above the cable route, and the fall of potential is noted on a voltmeter between the earth connection and the ground in contact with the brushes. Besides simplicity in operation and accuracy of results, other advantages of this method are that the smallest earth leakages can be expeditiously localised without interruption to the supply, the apparatus is cheap and simple in construction, while the test may be made by any one possessing elementary technical skill. The method is applicable to any system of supply, whether direct or alternating. In the case of a two-wire supply, it is only necessary to earth the unaffected conductor to give the required potential difference surrounding the fault.

The author has found in practice that it is much more satisfactory to obtain testing current from the supply mains than to employ portable batteries, as the latter require to be maintained in good order, ready for an emergency, while the discharge current may be totally inadequate for the purpose of locating a fault, unless it happens to be a dead earth. In very few cases is it found

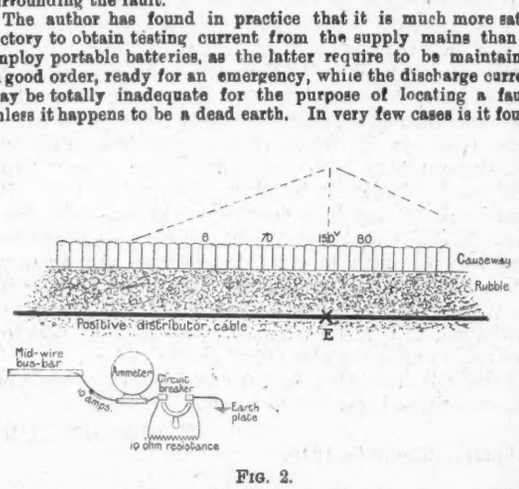


FIG. 2.

impossible to locate faults by the method described by the author, and in these recourse has been had to the well-known but more elaborate Wheatstone bridge methods or to Murray's loop test; these, however, require the disconnection of the faulty section.

In the discussion following, several speakers questioned the possibility of localising leakages on lead-covered cables by means of the earth potential method, and the author agreed that in the event of the lead covering being bonded throughout, other methods would be preferable. Replying to some remarks by MR. W. W. LACKIE as to linking up the network, the AUTHOR said that looking at the question from the standpoint of continuity of supply, the feeders were better interconnected by fuses in distribution pillars. A distributor with a bad fault on it, was useless throughout its length if supplied from one feeder only, whereas if fed from both ends, part of it could be kept in use all the time.

MR. MCWHIRTER doubted whether the earth potential method was of use where the ground was very dry, and covered with stone as in a large town, but the author stated that very satisfactory results had been obtained with cables buried 3 ft. deep in very dry soil covered with stone setts.

MR. MORGAN thought there were possibilities of accidents in the use of the testing panel described. The author pointed out that the only accident that could happen would be if the mid-wire earth

breaker were left in, whilst one of the outers were being earthed. The breaker would come out at once, and prevent damage.

MR. AUSTIN discussed the use of a compass needle in locating faults. The author was of the opinion that a compass, except for use in a street box, was useless for testing faults on underground mains.

With reference to a written communication by Mr. F. C. Raphael, the AUTHOR said that the method of testing described could be carried out close to tram-lines with the cars running; it was found easy to differentiate between the reading due to rails, and that due to cable leakage, as the latter was steady and exceeded 7 volts close to the fault.

Electricity in Mines.

AT a meeting of the MINING INSTITUTE OF SCOTLAND, which was held on April 13th, and was largely attended, in the Technical College, Glasgow, a discussion took place on a paper on "Electricity in Mines," by Mr. Robert Nelson, H.M. Electrical Inspector of Mines.

MR. C. A. ATCHLEY said that Mr. Nelson's strong defence of the three-phase system of supply as against continuous current would no doubt meet with cordial agreement on the part of most engineers. Unfortunately, mining conditions might also have to be taken into consideration, and in these days of extremely thin seams, continuous current had perforce to be adopted for coal-cutting, owing to the greater power which could be got into a light continuous-current motor. In any case, judging from the extremely satisfactory results which continuous-current machines had given for this class of work, it was doubtful whether a change to three-phase supply would be a great improvement, especially as the nature of the work rendered slip-rings almost a necessity. There was not a great deal to choose between a commutator and slip-rings, both, in his opinion, being equally objectionable in places coming under Sec. 8 of the Coal Mines Regulation Act. One felt bound to question Mr. Nelson's advocacy of the concentric system, as in his (Mr. Atchley's) experience it had been a source of trouble owing to its very construction inviting an insulation breakdown, when a repair was a difficult thing to carry out properly and satisfactorily. Vulcanised bitumen had undoubtedly proved the most satisfactory insulating medium, and in conjunction with this, the use of armoured cable in all main roads, as suggested by Mr. Nelson, would seem to offer a cable as good as any that could be devised. On the other hand, Mr. Nelson's recommendation as to the use of a copper sheath for earthing purposes, in additon to armouring, might be desirable and necessary in parts of the country where it was the practice to work with very large fields, but in Lanarkshire it would surely appear to be absolutely unnecessary. Mining engineers would welcome Mr. Nelson's definition of what be considered to be satisfactory earthing, as this had been a contested point almost since the time when the necessity for earthing in connection with mining electrical installations became an acknowledged fact. To those many engineers who had become used to the unarmoured cable system and who had adopted the armoured system, it would seem necessary to greatly emphasise Mr. Nelson's warning that such a system was much more dangerous than that embodying unarmoured cables, unless every precaution was taken to ensure that the whole armoured system of the pit was made electrically continuous back to suitable earths.

MR. FRANK ANSLOW, Glasgow, said that Mr. Nelson's paper contained many useful hints for the design and carrying out of electrical mining equipment, but when in this and the paper he recently read at Birmingham, Mr. Nelson dealt with the broad principles of the systems possible for electric installations, he was scarcely so convincing. As regarded the system of supply, being interested in a large amount of alternating plant at present being installed, he was satisfied that that system possessed many valuable features especially for use in fiery mines, but its application was limited. Direct current had also its special points, not the least of which was its more general adaptability for driving any class of machinery, and it appeared to be quite within the region of possibility that this system would regain its once pre-eminent position. In many cases, indeed, where alternating current was used, converting apparatus had to be installed for supplying direct current to machinery which could not efficiently be operated by alternating current. Regarding the source of supply, no doubt the various power companies had been quite a boon to collieries in isolated districts, which had thus been enabled to take advantage of electric working at a reasonable cost and without any capital expenditure in steam raising and generating plant. On the other hand, however, it was not clear, in view of many instances which had come under his notice, that power companies could supply electricity at a cheaper rate than that at which it could be generated in even a moderately-sized power station situated at a colliery. It must not be forgotten that in many existing collieries, use could be made of exhaust steam, and further (especially in Scotland), there was frequently a quantity of dross available which had no marketable value, and which having quite a good calorific value could be economically used for steam-raising purposes. He thought Mr. Nelson was quite right when he stated that the use of armoured cables ensured the work being properly carried out. It was particularly adaptable, of course, to the protective system recommended by Mr. Nelson in the course of his paper.

MR. SAM MAVOR, Glasgow, said that Mr. Nelson's contribution was an extremely valuable one. Near the beginning of his treatise, Mr. Nelson curtly dismissed continuous current in favour of the three-phase system, he did not think that that was warranted. For large areas of supply, and in the case of large collieries requiring to introduce power over a considerable distance, there was no question whatever that three-phase was the best system. In Scotland, however, there was a large number of relatively small collieries requiring small quantities of power, and it was not, in his opinion, to be accepted that the three-phase system was necessarily the best for these conditions. It seemed to him that in regard to the Scottish collieries this was much less a matter for electrical experts than for colliery engineers.

The PRESIDENT said that Mr. Mavor's remarks showed that amongst electrical people themselves there was a diversity of opinion as to which was the better system. What they, as mining men, should look at was what was the safer and more economical system.

MR. ANDERSON said that he could very well homologate all that Mr. Mavor had said in relation to the direct current as opposed to the three-phase coal-cutters. In a great many cases he thought colliery managers were badly advised to adopt the three-phase system when, from every point of view, the conditions conclusively pointed to a direct-current supply. It had been represented that the use of armoured cables tended to better workmanship. His experience in coal mines, however, had been the very opposite. He did not think that he had seen more shoddy work carried out anywhere than where the armoured system was adopted. Possibly that was due in a measure to the fact that the people in charge of armoured cables did not realise the terrible responsibility attaching to the man who was responsible for the upkeep of armoured cables in a pit. Personally, he did not think he would like to be one of these men. He considered that there should only be one earthing point in connection with a colliery installation, and that should be on the surface. He had no objections at all to taking advantage of any earthing that might be got in the mine, but he had very strong objection to offer to that being regarded as reliable. He thought that one was well advised, in an earthing system, to rely on a complete metallic return. The greatest care was necessary, when using armoured cables, to see that the armouring was continuous throughout.

The PRESIDENT stated that he had seen many armoured cables, and was not greatly taken with them, because they got twisted in all sorts of ways and the wires got away from the cable.

MR. MARTIN stated that in the Newcastle area he learnt from practical experience that the protective system advocated by Mr. Nelson had proved of real value.

MR. JAMES T. FORGIE, Bothwell, said he thought those who had experience for a number of years of electricity had found in a great many mines in Scotland that the continuous-current system had served its purpose exceedingly well. Mr. Nelson's experience had been greatly gained in large collieries, where they had places three or four miles from the pit bottom, and where the current was carried an extremely long distance the alternating system was the best. There were mining people who had experience of both systems and they were most decidedly in favour of the alternating supply. These, however, were chiefly English people. He, as a Scotsman, who had had a large experience of large and small mines, had no hesitation in saying that for a small installation the continuous-current system was certainly the best.

LEGAL.

WHEELER *v.* MARYLEBONE BOROUGH COUNCIL.

THE Marylebone Borough Council, in its capacity as supplier of electric current in the borough, was sued on Thursday, May 26th, before Mr. Justice Grantham and a special jury in the King's Bench Division by Mr. John James Wheeler, a Woodford Green builder, for damages for personal injuries he received, which, he alleged, were caused by the Council's negligence.

MR. DUKE, K.C., appearing for the plaintiff, said the injuries from which his client suffered were received under peculiar circumstances. Mr. Wheeler was a builder in a large way of business, and he undertook the rebuilding of a large house in Devonshire Place, W. Running through the vaults of the house was an electric cable, an inch thick, which supplied the house with electricity. There was no doubt that the housebreakers employed by Mr. Wheeler gave the Council notice to withdraw the supply, for notes of that fact were found in the Council's books. It was not necessary to remove the cellars under the house, and one day in April last year Mr. Wheeler, who was superintending the rebuilding, saw what he thought to be an old leaden pipe, which, he considered, was in the way. With chisel and hammer in hand he commenced to cut it off, and he gave two or three blows when a loud explosion occurred, a bright sheet of flame lit up the place, and he was violently thrown against a wall 4 ft. away, where he became unconscious. When he regained his senses, he found that his left hand which held the chisel was very badly burned, the nail of his thumb was burned off, his clothes were damaged, and his eyebrows and hair were singed. He suffered from severe shock for a long time, and spent a considerable period under the doctor's care. The foreman who gave the Council notice to cut off the current was dead, so that they could not produce the definite message which was sent to the Council, but there was no doubt that they received a message, and acted upon it, because in the Council's books were the instructions sent to one of their employés, as follows:—"Cut service and pot cable. Remove

service for housebreakers." Then, said counsel, somebody evidently altered his mind, for above that was written the words, "Unnecessary to remove service, as cellar was not coming down. Meter D.I. and electric switch removed." So that it was evident that the Council knew what was expected of them, but they had neglected to do their duty. There was no doubt that an electric cable looked like a gas pipe, and it was in the cellar in question without any caution being given to persons on the premises as to the fact that it was alive. Yet the defence to the action put forward by the Council was what he considered astounding, for they said that the plaintiff was trespassing when he cut the pipe. As a matter of fact, he (counsel) considered that the Council had been guilty of a serious negligence, and were answerable for the consequences.

MR. WHEELER then gave evidence corroborating his counsel's statement.

MR. JOHN LYNTON, the assistant engineer to the Charing Cross Electric Light Supply Co., was next called on plaintiff's behalf. He said he thought that a person holding the ends of the cable in question would receive a shock, but it would not be sufficient to kill. The voltage would not be high enough.

In answer to his LORDSHIP, MR. HOLDEN (with Mr. Shearman, K.C., for the defendants), said the supply in Marylebone was what was called the three-wire concentric system, and the pressure between the negative and positive conductors was 480 volts. By an intermediate conductor called the neutral or earthed conductor two complete services were got, one from the negative to the earthed conductor, and the other from the neutral to the positive, each being of 240 volts, so that a pressure of not more than 240 volts was got in each house.

COUNSEL (To WITNESS): Have you ever known a case where a cable has been pot-ended and the dead cable left in the house?—No, we always take away dead cable.

What would you understand if you saw a cable in the house?—That it was alive.

His LORDSHIP: But I or the ordinary bricklayer or builder would not.

MR. HOLDEN: But your Lordship would not attack a cable with a chisel. (To witness) Would you remove a cable if the rebuilding operations were confined to the top of the house? Not always. Witness added that he would not remove the cable if the housebreakers were not going to interfere with the cellars.

MR. HENRY THOMAS GORDON, architect and surveyor, said he always specified that all pipes and cables should be removed from cellars or anywhere else when housebreakers were at work. As a matter of fact, considerable alteration was made to the cellar where the cable was, and therefore it was imperative, in his opinion, that the cable should have been removed.

MR. MONTAGUE SHEARMAN, K.C., for the defence, explained that when the Council were notified that the housebreakers were going to commence work, one of the Council's employés was instructed to "draw the service," which meant that the whole of the wires and cables in the house were withdrawn, but when he got to the house he was told that the cellars were not to be removed, so he simply shut off the current from the cut-out box in the cellar. That was perfectly safe, even if the cellars were used, and the plaintiff did the only possible thing to cause trouble when he tried to cut the cable. He simply short-circuited the current, with dire results. They felt sorry for him, but he suffered for a supreme act of folly, for he must have known that the cable was a live one. He contended that the Council had not been guilty of a breach of duty and were not liable in that action.

After medical evidence had been given, MR. SIDNEY J. JONES, the assistant meter-reading superintendent in the Council's employ, said he shut off the service at the cut-out box.

MR. CHAS. HUBERT SMITH, the constructional engineer of the Council, said he visited the house after receiving the request to draw the service, and was told by the foreman housebreaker that as the cellars, which were away from the house, were not to be interfered with, there was no need to remove the cable, so he altered his instructions to the jointer, telling him to draw the service as far as the cut-out box and make that secure. The foreman told him that all he wanted removed was the meter and the appliances within the house. Referring to custom, Mr. Smith said that, bearing in mind that it was a very expensive matter to meddle with or alter the service beyond the cut-out, the cables were left in their positions as far as was consistent with safety, but in this particular case, had he known that the structure of the cellars was going to be interfered with, he would not have let the cable remain, but would have had it removed. He certainly would not have left a dead cable in the house. "They are worth money," he added.

MR. JOHN F. C. SNELL, consulting engineer, said he had had 20 years' experience as engineer to many electric undertakings, and the system of leaving a cable in a cellar, such as the one in question, as long as the cellar was not to be interfered with, was universal. It was perfectly safe and was harmless unless cut or tampered with.

MR. ALBERT H. SEABROOK, general manager of the council's electrical undertaking, also gave evidence, and the hearing was adjourned.

The hearing was continued on Friday, when MR SHEARMAN, K.C., argued on behalf of the defendants that the plaintiff had been guilty of contributory negligence. He was an experienced builder who should have known an electric cable from an ordinary leaden pipe, and he had only himself to thank for what had happened.

MR DUKE, K.C., for plaintiff, said if the Council had done what was requested of them, the accident would not have happened. Instead, in the hope of saving expense, only half of the work was done, and a live cable was left in a place where it was a danger to everybody on the place. Had they placed a switch in the service box under the pavement, and right away from the house, and cut off the power at the switch, the cable would have been rendered harmless, and they would have saved the expense which they said would have been incurred by drawing the cable. These premises were to be destroyed, everything was to be taken away as useless, and it was absurd to say that plaintiff should know that what looked exactly like a lead pipe was in reality a live cable.

His LORDSHIP, summing up, said he thought that the Council had been guilty of a wrong in leaving the cable in the cellar without giving the plaintiff notice.

The jury found for plaintiff, awarding him the special damages claimed, with £75 for suffering endured, and £450 for loss of work.

His LORDSHIP entered judgment accordingly, and refused a stay of execution.

ECCLES CORPORATION *v.* SOUTH LANCASHIRE TRAMWAYS CO. AND THE SALFORD CORPORATION.

THIS case came before the Court of Appeal composed of the Master of the Rolls and Lords Justices Farwell and Kennedy on Thursday last, upon the plaintiffs' appeal from a judgment of Mr. Justice Eve in the Chancery Division. By their action the plaintiffs claimed a declaration that the Salford Corporation were not entitled to authorise the defendant company to use the plaintiffs' tramway or any part thereof, and an injunction to restrain the defendant company from running cars over the plaintiffs' tramways situate in the borough of Eccles. It appears that the borough of Eccles is bounded on the east by Salford and on the west by Worsley. The defendant company work tramways in the Worsley urban district and up to the western boundary of the borough of Eccles, but they have no powers to work tramways within that borough. By the Eccles Corporation Act, 1901, Sec. 24, the plaintiffs were empowered to enter into contracts with owners of tramways in any adjacent district capable of being worked with the plaintiffs' tramways with respect to the working by the contracting parties of their respective tramways or parts thereof. Under agreements April 11th, 1902, and July 31st, 1907, tramways within the borough of Eccles have been constructed and worked by the Salford Corporation, the plaintiffs supplying the electrical energy. The agreement of April 11th, 1902, provided for the granting by the plaintiffs to the Salford Corporation of a lease for 35 years to run cars with flanged wheels upon the tramways within Eccles borough, subject to the terms mentioned in the fourth schedule of that agreement. The fourth schedule provided for the licensing by the plaintiffs of the Salford tramcars plying for hire within the borough of Eccles, that they should work the tramways to the best of their ability, and should not assign, sublet, or part with the benefit of that agreement or the lease except by licence under the seal of the plaintiffs. Pursuant to the agreements, the Salford Corporation have worked the tramways, and on June 2nd, 1908, they granted a licence to the defendant company to run cars over that portion of the tramway which lies between Alder Forest and Parrin Lane. The defendant company did not apply for or obtain any licence from the plaintiffs, the Salford Corporation claiming the right under the agreements to authorise the defendant company to run cars within the borough without any such licence. The plaintiffs alleged that the defendants, by wrongfully running cars within the borough, were trespassing on the tramways and causing damage to the plaintiffs.

Mr. P. O. Lawrence, K.C., and Mr. Harman appeared for the plaintiffs; Mr. Jessel, K.C., and Mr. Austen Cartmell for the defendant company; and Mr. Edward Clayton, K.C., and Mr. MacSwinney for the Salford Corporation.

At the conclusion of the arguments of counsel, the MASTER OF THE ROLLS, in giving judgment, said that the power conferred by Sec. 34 of the Tramways Act, 1870, was limited to the promoters and their lessees, the promoters being the person or company authorised to construct the tramways. The right conferred was a personal one, and could not be claimed by any person who did not come within the designation of promoters or lessees of promotion. It was not conferred upon the promoters' assignees. A conveyance, therefore, by the promoters of their tramways or even of their undertaking would not carry with it the right to the statutory monopoly conferred upon the promoters by the Section in question. The Tramways Act, 1870, contained various provisions entirely consistent with that view. So far as that Act was concerned, it seemed plain that the first defendants, the South Lancashire Tramways Co., were liable to a penalty, because they were using on a tramway carriages with flanged wheels, not under a lease from or under any agreement with the promoters or under a licence from the Board of Trade, for the Act of 1870 drew a clear distinction between promoters and lessees, and there was nothing which could justify anyone in saying that promoters included lessees, and that it was sufficient for a person to get a licence from the promoters. The Eccles Corporation Act, 1901, incorporated the provisions of the Tramways Act, 1870, so far as there was nothing inconsistent with them in the Act itself. It was plain that the Eccles Corporation could not have made an agreement authorising the South Lancashire Co. to use their tramways without the licence of the Board of Trade, and, therefore, it was hopeless to say that the Salford Corporation, to whom the Eccles Corporation had granted a limited use of the tramway, had greater powers than the Eccles Corporation had, and could at their own will and pleasure and on such terms as they thought fit without asking the consent of the Board of Trade give a licence to the South Lancashire Co.

His Lordship was unable to assent to the view that a clause which authorised Corporations to enter into agreements with the consent of the Board of Trade, could be construed as authorising them to enter into agreements without that consent. He therefore thought that the plaintiffs were entitled to the relief claimed.

The Lords Justices also delivered judgments allowing the appeal.

Plaintiffs, through their counsel, undertook not to take any steps to enforce the injunction for the space of one month.

MID-OXFORDSHIRE GAS LIGHT AND COKE, &c., CO.

In the Chancery Division Companies' Winding-Up Court on Wednesday, May 25th, before Mr. Justice Swinfen Eady, the petition was mentioned of Lucy Ann Richards, for the compulsory winding-up of the Mid-Oxfordshire Gas Light and Coke Co. It was an undertaking with several stations in towns throughout Oxfordshire, and supplied electric light as well as gas.

MR. C. NOAD, for the petitioner, said it was a petition by a debenture-holder who had secured judgment in the King's Bench Division. It was now stated that a resolution for voluntary winding up had been passed by the company, but he had had no evidence of it except by an affidavit which had been filed by the other side, but which was three weeks out of time.

MR. GALBRAITH said he appeared for creditors to the amount of £6,728, and he opposed the petition.

After further hearing, his LORDSHIP ordered the matter to stand over until next Tuesday week, with liberty to amend the petition and file further evidence.

GREVENER *v.* CHAMBERLAIN.

In the Shoreditch County Court on Thursday last week, before his Honour Judge Smyly, K.C., an action was heard in which Mr. Julius Grevener, of Eldon Street House, Eldon Street, electrical engineer, the duly appointed attorney of the Sachsenwerk Licht und Kraft Actiengesellschaft, lately trading in London as the Electromotor and Dynamo Co., Ltd., sued George Chamberlain, of John Street, E.C., a builder, to recover £49, the value of an electric motor and £1 damages for its detention. The case for the plaintiff was that the defendant was the owner of premises in Finsbury, which he let to a tenant named Gover, who hired a motor from the plaintiff company, on the understanding that he should obtain a written agreement from the defendant that in the event of an execution for arrears of rent he would not seize it. This agreement was actually signed, but in spite of this the motor was seized under an execution and subsequently sold.

MR. KARL KOPECH, for the plaintiff, gave evidence as to the hiring of the motor by Mr. Gover, the sum of £59 being the amount mentioned in the agreement.

DEFENDANT'S COUNSEL: Is the Sachsenwerk, &c., company a German firm?—Yes.

And carrying on business in England?—Yes.

In July, 1909?—Yes.

By Sec. 274 of the Companies' Consolidation Act of 1908 every company incorporated outside the United Kingdom and trading therein must be registered, under a penalty of £50, and £5 for every continuing day of default. Has this company been registered in the United Kingdom?

PLAINTIFF'S COUNSEL: I object to that question.

JUDGE SMYLY: I do not see how you can object except on the ground that the company is not bound to incriminate itself.

It was admitted that the motor had been sold, so plaintiff's counsel said all he had to put his mind to was the price, and he then detailed the hiring prices, cash prices, the time the machine had been used, the amount allowed for depreciation, and how they had arrived at the figures of their claim.

The defence was that the value of the motor had been greatly exaggerated—the claim being for £49 and £1 as damages for detention.

JUDGE SMYLY carefully studied the figures, and then asked if the machine could be returned, and was informed that it could not, as it had been sold. His Honour then said he could find nothing wrong with the claim, and there would be judgment for the plaintiff for £50 and costs. An application was made that the money should be paid by instalments, but his Honour said he had no power to interfere.

CITY OF BIRMINGHAM TRAMWAYS CO., LTD., *v.* GEORGE LAW.

In the King's Bench Division, on Saturday, May 28th, Mr. Justice A. T. Lawrence gave judgment in this case, which was heard at the recent Birmingham Assizes. His LORDSHIP said that this was an action to recover compensation for personal injuries to a passenger whilst travelling on a tramcar. The damages were agreed at £421 in the event of the plaintiffs establishing the defendant's liability. The accident occurred on October 4th, 1909, when a car was travelling at a slow pace on an up gradient up the Bristol Road, which was a main highway out of Birmingham. There were two lines of tramways, but only one was really in use, the second one being under reconstruction by the defendant, who was the contractor for the work. An examination of the spot immediately after the accident disclosed that one of the wooden blocks had become displaced, and it bore traces of a blow. After careful consideration, his LORDSHIP came to the conclusion that the derailment of the car was due to the wooden block. He held that there was negligence in the execution of the works. He also held that the passenger who received the injuries was a passenger at the time of the accident. On all the facts, he found for the plaintiffs, and gave judgment for the amount agreed to.

MR. BATTEN, K.C., with submission, thought that there had been no agreement as to the question of damages, and he asked that the matter should be referred to Mr. Whittock, Registrar at Birmingham.

His LORDSHIP said he would grant the application, and, in the meantime, would look up his notes on the matter. He also granted a stay of execution for three weeks pending an appeal.

BOLTON *v.* RAILWAY, FINANCE AND CONSTRUCTION CO., LTD.

In the King's Bench Division on 27th ult., according to the *Financial News*, Mr. Justice Darling and a special jury had before them an action brought by Mr. Tom Bolton, civil engineer, of Westcliff-on-Sea, against defendants, formerly known as the Electric Equipment and Securities, Ltd., to recover arrears of salary and damages for alleged wrongful dismissal. Plaintiff's case was that he entered into an agreement under which he was to remain in Colombia for one year and nine months at a salary of £600 per annum. He was taken ill with malaria, and had to leave the place where he was working in order to obtain medical advice and rest. When he was ready to resume his work plaintiff alleged that the defendants would not allow him to do so, and wrongfully terminated his engagement.

The DEFENDANTS denied that they dismissed the plaintiff, and said that he himself put an end to his engagement. They also counterclaimed to recover money which they had over-paid.

The jury having answered various questions, his LORDSHIP entered judgment for the defendants on the claim, and also on the counterclaim for £10, with costs.

REVIEWS.

Electrotechnics. Vol. III. By I. HENDERSON, D.Sc. London: Longmans, Green & Co. Price 3s. 6d.

This excellent little book is divided into three portions of about 50 pages each, and it also contains a set of useful tables and logarithms. These tables are more up-to-date and useful than is usually the case in treatises of this description.

One notices the term "resistivity" used a good deal, yet in the table for "resistivity" of metals (page 154) one column is headed "resistivity in *michoms* per c.c., whereas for liquids, "specific resistance" in ohms per c.c. is used.

In the table headed "Incandescent Lamp Tests" the watts per candle, for tantalum and Osram lamps respectively, are given as 1·9 and 1·4. This seems rather a high value. In the table below referring to arc lamps, instead of "watts per candle," "candles per watt" is used, which seems somewhat unnecessary.

The table headed "D.C. Motors and Generators" gives B.H.P., R.P.M. and weight. The speeds vary between 550 and 915 R.P.M., so that the weight per B H.P., if that is intended, is hardly comparable.

Part III of the book deals with alternating currents, and here one has the usual selection of tests. These include the three-ammeter and three-voltmeter methods, which, however interesting from an academic point of view, are rarely used in practice. Here, of course, there is the sine curve and constant coefficient of self-induction, besides vector combinations. Nothing is stated here regarding the limitations of sine curve applications; but, of course, as this is only a laboratory handbook, that is hardly to be expected.

With regard to the second portion of the book, there is a series of some 54 tests occupying a page apiece. Some of the tests are very instructive, and amongst them may be mentioned those on "Absorption of light by lamp globes," "Combined efficiency of a motor-generator plant," "Eddy current and hysteresis losses," &c. The "Captious Critic" (as the reviewer is generally termed) might take exception to the term "efficiency" of an incandescent lamp. Would it not be better to call it "test" of an incandescent lamp instead? The tests of switches and cut-outs would be greatly increased in value if those on pages 94 and 96 had a diagram of connections similar to that on page 106.

It is specially pleasing to notice the test "standardisation of a Kelvin balance by copper voltameter." The writer has

long been accustomed to allow his first-year students to do this, but in many institutions the Kelvin balance is regarded as something only to be looked at, and an instrument which measures the current "absolutely."

The tests on hardening and annealing effects, page 54, will probably be difficult to perform, as evening students require "quick" tests, their time being so limited. As for the test on "current-carrying capacity of wires," page 53, the wires are in the form of spirals, and so the results are not applicable to straight conductors, and hardly represent what is generally regarded as "current-carrying capacity."

Part I contains 51 experiments, and this portion of the book will come as one of Lloyd-George's "windfalls" to teachers who have to cudgel their brains to get a set of elementary experiments together. The writer thinks it hardly correct to use the term "ageing" for the annealing process detailed on page 40 in the test on permanent magnets. No doubt in transformer iron, "annealing" and ageing are practically the same thing, but it hardly applies to a permanent magnet.

On page 32 it is stated, "It has been shown by Preece that the fusing current," &c., and then follows—

$$c = k\,d^{\frac{3}{2}}.$$

This formula was, the writer believes, deduced in the first instance by Kempe, and Preece proved the truth of it experimentally. It should, therefore, be called "Preece and Kempe's rule."

The first experiment is to "prove" Ohm's law by means of ammeter and voltmeter. This is no doubt sufficient for the ordinary evening student, but if the voltmeter works by assuming Ohm's law, as many of them do, it would appear that the student is merely working in a circle. Dr. Ohm proved his celebrated law without using any ammeter or voltmeter.

However, Dr. Henderson is to be congratulated on the production of a most useful treatise, and, of course, in a review it is impossible to do more than merely refer to a few points.

The book will prove of immense service to those teachers who require a set of experiments suitable for evening students of the Polytechnic type.

Practical Testing of Electrical Machines. By LEONARD OULTON, A.M.I.E.E., and NORMAN J. WILSON, M.I.E.E., Assoc.Am.I.E.E. London: Whittaker & Co. Price 4s. 6d. net.

The object of the authors in writing this book has been, as is explained in the preface, to show in pocket-book form for the use of engineers and students, the various tests which are necessary in connection with alternating and continuous-current generators, motors, and rotary converters. Great pains have been taken to go very minutely into the details of these tests, and instructions are given as to how they should be performed, and how to work up and plot out the results when obtained. There are 90 illustrations, consisting in the main of curves referring to the tests of various machines, and of diagrams of connections. Five diagrams illustrate different ways of obtaining three-phase current from a two-phase supply system by means of static transformers, and there is useful information on the subject of the measurement of three-phase power with two wattmeters, and with three. There is a careful explanation of the Heyland diagram, and some attention is given to the question of the phase relationships between the wattful and wattless components of an alternating current. With the exception of these last, however, the book deals with practical work, though it may be remarked that without considerable theoretical knowledge on the part of the authors, it could not have been written. It would be possible to replace three pages of equivalent temperatures (Centigrade and Fahrenheit) by a curve, or by the ordinary $C° = \frac{5}{9}(F° - 32)$ without taxing the practical man's mathematical skill too highly.

The literary quality of the book is not of so high an order as the technical ability revealed in its composition. The use of the word "same" as a relative, which forms so deplorable a feature of much business correspondence nowadays, is frequent throughout the book. The word "aforegoing" (page 190, paragraph 6) is new to us.

Marcus Aurelius says: "Take no thought to set out thy words in curious neat language," and it is not to be expected that, in a book for use in the shops, writing of a standard equal to that of, let us say, Lord Morley of Blackburn, should be found. We do think, however, and writers in our columns have frequently said, that the literary engineer might be a little more literary without being less of an engineer.

Electricité Agricole. By A. PETIT. Paris: Baillère et Fils. Price 5 fr.

This work forms part of the *Encyclopédie Agricole*, a series of 60 volumes, and is intended to aid agriculturists in adapting and applying electrical science to their needs. It is written, therefore, in simple language, though the author wisely makes no attempt to avoid the use of technical terms. Commencing with general considerations, including explanations of the electrical units, and of the characteristic features of electrical systems, the author proceeds to describe the methods of generating electricity, its distribution and utilisation. Existing installations are described, with particulars regarding the cost of running and maintenance, and it is interesting to observe that the use of electricity for ploughing, thrashing, and other ordinary agricultural operations, is far advanced on the Continent, while in this country it is, we believe, practically unknown. There are numerous openings for electrical power in connection with saws, chaff-cutters, pulpers, dairy-work (including refrigeration), pumping, thrashing, sawing, &c., as well as for other purposes such as lighting, sterilisation of water, &c., with ozone, and so on. Power is obtained from waterfalls where these are available, suction-gas plant, oil engines, &c., or sometimes from a public supply system or an installation run on a co-operative basis. M. Petit's work, which embraces over 400 pages, is full of interesting matter bearing on the subject, and we should be glad to see a similar one in our own tongue. We regret to note that only one page is devoted to the action of electricity upon the growth of plants, a direction in which we expect to see great developments. The author regards the matter as not having yet reached the practical stage, but in this respect we believe the British, thanks mainly to Sir Oliver Lodge, are really ahead.

Electric Waves: An Advanced Treatise on Alternating-Current Theory. By W. S. FRANKLIN. London: Macmillan & Co. 1909. Price $2.

A wide scope is embraced by this work, covering the theory of propagation of guided waves along conductors, the formation and propagation of free waves in space, dynamical principles of wave motion generally, and the application of electric wave theory to power transmission line problems and to wireless telegraphy. The method of treatment adopted is suitable for the student, and the matter is handled and expressed in a manner commendable for its lucidity.

The plan of treatment is a new departure in text-book methods, and of sufficient significance to demand special comment. The proper physical conceptions of the various processes concerned are first unfolded and freely illustrated by diagrams, showing the interaction of the electric and magnetic fields of force. This is made to lead up to the mathematical treatment of the subject, so that the student will be already prepared for the results of the investigation, and will, therefore, much more readily grasp and appreciate the inner meaning of the mathematical processes concerned. Fourier's theorem in its application to periodic motions of all kinds, harmonic analysis, scalar and vector notation, and, in short, the application of all higher branches of mathematics to physical operations, can only have their full realisation and significance when associated with some method of visualising the processes in the minds of students. Considering the problem of the transmission of distortionless impulses along a conductor, it is not sufficient, nor is it satisfying to practically-minded students to be able to work out the equation expressing the relations between the

various electrical quantities concerned, unless the imagination is assisted by sufficiently accurate general conceptions of the physical processes of transmission.

It is, for instance, highly desirable to realise the effect of capacity of the wires in producing increased attenuation in virtue of the tendency it produces to set up a reverse or counteracting impulse or wave; in other words, to reflect and distort the transmitted waves. Without an adequate mental picture of the process, no student can fully realise the why and wherefore of the relationship of the various electrical quantities as expressed in the equation for distortionless transmission. As stated by the author in his preface to the work, it is necessary to realise "how an electric wave waves." When this has been done, the mathematical expressions representing the operations will have increased their value manifold. A mathematical process will then become a tool which can be modified or remade to suit the particular problem concerned, rather than a hard-and-fast relationship of quantities which can only be treated in certain regular ways.

Whilst some small degree of consideration has at times been given in other text-books to the types of physical conceptions incorporated in this work, they have never before been so completely and satisfactorily treated. The authors have, in most cases, signally failed to do them justice, and have often, indeed, distorted them almost to absurdity. The kind of treatment accorded here has, however, been published previously in a form so similar and with diagrams so obviously like those used in the present work, that it is rather remarkable that no acknowledgment is made. The pages of the ELECTRICAL REVIEW, April 19th, 1907, *et seq.*, contain the publication referred to.

In perusing the work it is, perhaps, a little disappointing to find that the theory of wireless telegraphy is all too briefly discussed. It is, however, worthy of note that in the method of depicting the radiation from a wireless telegraph aerial by means of the electric strain-lines (illustrated on page 210), the author has wisely avoided falling into that trap for the unwary into which most writers of text-books promptly drop. He has restricted the method of explanation to the radiated waves proper, and avoided any attempt to explain the actions occurring in the field of force immediately surrounding the aerial on any assumption of lateral motion of lines of strain, and in so doing has exercised a wise discretion. In a wider treatment of wireless telegraphy theory on the plan adopted in this book, it is yet possible to bring home to the student even more fully the dynamic principles involved both in transmission and reception of electric waves, but the author is to be congratulated on the fact that, so far as he has taken it, his treatment is unique in its accuracy.

The book is one which can, without hesitation, be recommended to electrical engineering students of all classes.

BUSINESS NOTES.

Water Purifying Plant.—Among the orders recently received by the PATERSON ENGINEERING CO., LTD., for Paterson water purifiers are the following:—

H.M. Dockyard, Pembroke, a repeat order for the generating station.
India Office, two orders.
Hull Corporation, repeat order for the tramway power station.
General Post Office generating station, Blackfriars, to the order of Messrs. Alton & Co.
Messrs. J. G. White & Co., repeat orders for the Lacroze Electric Tramways, Buenos Ayres, and for the Para Electric Tramways.
J. Lysaght, Ltd., Scunthorpe, near Doncaster.
Midland Electric Corporation for Power Distribution, Ltd., for Ocker Hill generating station.

The firm have also completed a number of plants for export, and have in hand at the present time plant for a number of industrial firms in this country.

New Works at Darlington.—A new industry is about to be commenced at Darlington where the Swedish Steel Rope Wire Co. have acquired premises for the purpose of wire-drawing. The partly manufactured material is imported from Sweden, and after the wire has been drawn it will be sent principally to South Africa. Extensive premises have been taken off Northgate, and machinery is now being installed, which will be electrically driven. The premises have been taken on a 10 years' lease, and those interested in the undertaking are Messrs. J. H. Roberts, W. H. Wood and J. J. Yates.

Book Notices.—"*Journal* of the Institution of Electrical Engineers," with index to Vol. 44, 1910.—The issue for May, 1910, contains the following papers:—"The Work of Lord Kelvin in Telegraphy and Navigation," by Prof. J. A. Ewing; "Equitable Charges for Tramway Supply," by H. E. Yerbury; "An Electrical Safety System for Mines," by H. J. Fisher; "An Investigation as to the Most Economical Vacuum in Electric Power Stations Employing Steam Turbines and Cooling Towers," by R. M. Neilson; "The Testing of Rubber for Electrical Work," by Prof. A. Schwartz; "The Influence of Cooling Media upon the Rise in Temperature of Soft Iron Stampings," by R. D. Gifford; "The Present Aspect of Electric Lighting" (discussion at Manchester), by H. W. Handcock and A. H. Dykes; "Overhead Line Construction," by W. B. Woodhouse.

The Brassworkers of Berlin and of Birmingham. London: P. S. King & Son. Price 6d. net.—This report of the visit of three Birmingham brassworkers to Berlin, to investigate the social and industrial conditions obtaining there, was originally issued about five years ago, and is now in its fifth edition. It contains a great deal of information on the life and living of the German workman, and being the work of three observers of different political views, it professes to present an impartial record of facts, from which the reader may draw his own conclusions. The report is already well known, and deserves a wide circulation.

"*Bulletin* of the Société Belge d'Electriciens." May, 1910. Brussels: Ramlot Frères et Sœurs.

"The Physical Review." Vol. XXX, No. 5. May, 1910. Lancaster, Pa.: The *Review* offices.

"*Proceedings* of the Physical Society of London." Vol. XXII, Part 1. May, 1910. London: Taylor & Francis.

"Vibrations of Systems Having One Degree of Freedom." By B. Hopkinson, M.A. Cambridge Engineering Tracts, No. 1. 1910. London: Cambridge University Press. Price 2s. 6d. net.

"Reduction of Working Costs on the Rand." By the Special Commissioner of the *Investors' Guardian*. London: *Investors' Guardian*, Ltd. Price 1s.

"Rapid Transit in the Future." By E. W. C. Kearney. Second Edition. London: The Kearney High-Speed Railway Co., Ltd. Price 3d.

Where is the German Secret Syndicate Now?—The question as to where is the secret syndicate in the German electrical industry, which was referred to at length in this journal over a year and a half ago, arises in connection with the recent tenders submitted for the supply of the equipment for a country central station at Mulhausen, Thuringia. The object of the syndicate, which was composed of the principal manufacturing firms, was to avoid competition as far as possible in regard to public and other contracts, and to arrange or maintain prices in such a way as to prevent outsiders from having any prospect of being successful with their offers. But the syndicate has apparently either collapsed in the meantime, or the publicity given to its methods of working has caused it to be of little utility at the present time. That one of these alternatives seems to prevail may be concluded from the competition already mentioned, in which only four firms participated, namely, the A.E.G., the Siemens-Schuckert Works, the Felten & Guilleaume-Lahmeyer Works and the Bergmann Electricity Works Co. The tenders ranged from £18,200 to £21,800, or a difference of 20 per cent. between the lowest and the highest offer, and the contract has been awarded to the Erfurt department of the Siemens-Schuckert Works Co., which submitted the lowest tender.

Fuse Tests at Deptford.—The London Electric Supply Corporation inform us that the use of their name in a leaflet on Koolark fuses recently issued by the Electrical Apparatus Co. is not authorised by the Corporation, and the latter, moreover, are unable to agree with some of the statements contained in the leaflet with reference to tests of these fuses made at the Deptford generating station of the Corporation in May, 1907.

We have also received from the Electrical Apparatus Co., Ltd., a communication relating to this matter, in which they say that the statements in their leaflet refer only to 550-volt enclosed cartridge fuses, and do not in any way reflect upon Mr. Partridge's high-tension fuses.

Tantalum Lamp Prices.—MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., of Dalston, have issued a list of revised prices for the above lamps, which came into force on June 1st. The discounts, terms for contracts, &c., will remain exactly as hitherto. A quantity of copies of the leaflet will be furnished to any electrical contractor or dealer for distribution.

MESSRS. DRAKE & GORHAM, LTD., 66, Victoria Street, Westminster, S.W., have issued a circular (pamphlet No. 163) announcing reduced prices for tantalum lamps 20-250 volts, 5 to 50 c.p., which came into force on June 1st.

Bankruptcy Proceedings.—ROBERT BROWN, lately manager of the Traction Corporation, Ltd.—A sitting of the London Bankruptcy Court was held on Wednesday last week, before Mr. Registrar Giffard, for this public examination. The accounts showed liabilities £2,130, and no available assets. In the course of the examination, which was conducted by Mr. W. P. Bowyer, Assistant Official Receiver, the debtor stated that his insolvency was due (1) to liability for the costs of an action which he, jointly with the corporation, brought in 1906 against an employé of the company in relation to inventions for an improved surface-contact system of electric traction, for which witness had taken out patents in England and various countries; and (2) liability as surety for moneys he had found or borrowed for the corporation. Witness acted as manager from September, 1904, to December, 1908, of the company which was now moribund, and

latterly he had received no salary for his services. He incurred the liabilities from a desire to keep the company going, and to thus bring his patents to a successful issue. Further, he had friends among the shareholders, and he did not want them to lose their investments. Asked what expectation he had of being able to meet the liabilities for which he had given his personal guarantees, the debtor replied that he hoped, as his patents developed through the instrumentality of the corporation, to be in sufficient funds to enable him to meet all the liabilities. He had charged his patents to the extent of £4,050 by depositing them as collateral security with creditors of the corporation. At one time he had great confidence in the success of the patents, but the value greatly declined when the stud system of electric traction was abandoned in London some 12 or 15 months ago. This was his first failure. The Official Receiver remarked that the first meeting of creditors stood adjourned with a view to an offer being submitted for consideration, and the public examination must, therefore, stand over *pro forma*. Order accordingly.

R. E. Walker, electrical engineer and cycle agent, Eign Road, Hereford.—June 11th is the last day for receipt of proofs for intended dividend by Mr. M. J. G. Scobie, trustee, Official Receiver's Offices, Hereford.

W. S. Jenkinson, electrical engineer, Rodborough, near Stroud, Glos.—A first and final dividend of 10d. in the £1 is payable June 1st. Official Receiver, Station Road, Gloucester.

Catalogues and Lists.—Mr. H. Cressall, 13, Summer Row, Birmingham.—Mr. Cressall, who has been appointed agent for this country for Mr. C. Schniewindt, of Neuenrade (Westphalia), has sent us a copy of a catalogue consisting of a collection of neatly produced leaflets in binding cover, in which the "Schniewindt" asbestos woven net resistances are fully detailed and well illustrated, prices also being tabulated along with sizes, &c. Mr. Cressall is holding large stocks to meet immediate requirements.

Fireproof Doors, Ltd., 46, King William Street, London, E.C. —Booklet with "fire-coloured" cover, describing the "Dreadnought" fireproof doors and shutters.

Mr. E. Lowes, 116, Queen Victoria Street, London, E.C.—Leaflet relating to the "Thor" electric home laundry machine, consisting of a Westinghouse electric motor and a three-roll reversible wringer.

Messrs. Marshall, Fleming & Co., Motherwell.—A copy of the fifth edition of the firm's catalogue of cranes has been issued. It is a very fine production, containing a numerous collection of full-page photographic views showing the firm's electric and other cranes. A view of the erecting shop is first given, showing four 60-ton electric cranes in course of construction. Many three-motor travelling cranes are illustrated, including some for H.M. Dockyards at Devonport and Hong Kong, also four and five-motor cranes. Single motor electric cranes are shown, also special cranes for iron and steel works, among them being Goliath and double cantilever cranes; overhead, hand, locomotive steam, and electric wharf cranes are all found in this book, between the different sections of which space is left for inserting additional sheets. Anyone interested in factory and public and other large undertakings would find this catalogue useful.

Adams Manufacturing Co., Ltd., Bedford.—Four-page list briefly particularising their latest "Igranic" developments, including clapper and contactor type remote control switches, step-by-step slow-speed gear, series relay automatic starters, push buttons, regulators and other apparatus.

Messrs. Falk, Stadelmann & Co., Ltd., 83/97, Farringdon Road, London, E.C.—New supplementary catalogue (No. 304, 52 pages) of electrical fixtures, for use in conjunction with their general edition No. 279. The opening pages contain clear illustrations and prices of a number of admirable brackets, and there follow a variety of pendants, electroliers, adjustable pendants, silk shade pendants, portable standards, "Lux" candles, wireless cluster fittings, luminous radiators, and silk and glass shades; in every class there are very choice examples.

The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—Small folder just issued giving illustrations with particulars and prices of a special line of "Freezor" fans. Contractors and central-station departments can have quantities of the leaflets with their name and address printed on by making application to the company.

Messrs. Feld Bros. & Co., Ltd., 25, Budge Row, London, E.C. —Loose list describing and pricing their continuous-current table and bracket fan.

The Edison & Swan United Electric Light Co., Ltd., 36 and 37, Queen Street, London, E.C.—Several new leaflets giving illustrations and prices of ornamental electroliers and pendant fittings.

Dissolutions and Liquidations.—Automobile Electric Lighting Syndicate, Ltd., and The Polkey Automobile Electric Lighting Syndicate, Ltd.—Meetings are to be held at Queen's College, Birmingham, on June 28th, to hear an account of the winding up from the liquidator, Mr. A. R. Lancaster.

Mr. G. D. Smith announces that the partnership hitherto existing between Mr. F. W. Bridges and himself has been dissolved by mutual consent. Mr. Smith's business will be carried on precisely as before and at the same address.

Mozambique: Advice to Traders.—In a recent report the British Consul at Lourenco Marques states that he has often regretted the absence of adequate representation at Lourenco Marques of British iron and steel manufacturers, as also of those specialising in electrical apparatus as well as in railway and telegraphic material. The Consul writes as follows: "In connection with these important branches of home industries I have been at some pains to discover the amount of the annual outlay of the various departments of the administration of this province in goods for local use, and am satisfied that this may be taken as reaching a sum which would well repay a system of combined representation. At present there is no such thing as serious British competition, whilst Continental manufacturers are so keenly represented that the bulk of the orders are without difficulty obtained for them. I have often heard expressions of regret that but little opportunity is afforded to the various Government departments to avail themselves of the admittedly superior goods of these classes of British manufacture which, in other conditions, would doubtless here find a large and growing market. The fact is orders are usually given somewhat hastily, on the discovery that the need for any given object has become imperative. The system of tendering as we comprehend it appears to be imperfectly understood, with the result that instead of all orders on Government service being thrown open to public competition, with a liberal margin of time to admit of the response being thoroughly representative, the rule is to invite a number of local agencies to send in specifications or estimates, the treatment of which would at times scarcely coincide with our ideas of what constitutes the usual practice in such cases. Very frequently, moreover, an order is given at once, without any particular formality, and, naturally, goes to the local business house whose representative can produce the goods at the shortest notice, and, at the same time, give indications of possessing an intelligent knowledge of the requirement of the moment. The small share of Government business which goes at present to British manufacturers would appear, therefore, to indicate the necessity for the adequate local representation of a thoroughly representative group, ready at very short notice to fill in orders for goods of the character described, and with energy and foresight to discover when demand is likely to arise. I shall be happy to furnish full particulars to British manufacturers who may desire further information on this subject, which is one I regard as being of considerable importance to an extensive range of home industries."

Trade Announcements.—Messrs. Walter Scott and Co. (Edinburgh), Ltd., electrical engineers and agents, have removed their registered office, warehouse and showrooms to Telephone House, 149, Rose Street, Edinburgh. Telegraphic address, "Dynamo," Edinburgh; telephone number, "5,319 Central," as before.

The British Electrical Trade Supply and Bitumen Co., of Trundley Road, Deptford, S.E., announce that from June 1st the title of the company will be changed to the Dassek Bitumen Co. There will be no change in proprietors or management, and the alteration is only made to abbreviate the name.

The Easton Lift Co., Ltd., have taken larger premises, with offices attached, at "Express" Works, Short Street, Southwark, S.E. They have, therefore, vacated their workshops at Lambeth, and their offices at Westminster, and all letters should be addressed to "Express" Works, which will be the head office henceforth.

Messrs. Jesson, Birkett & Co., Ltd., notify that for the greater convenience of the trade, they have removed their London offices and showrooms from 27, Ely Place, to a more central position for the electrical trade, at 9, Newman Street, Oxford Street, W., and they invite the trade to inspect their manufactures at these showrooms.

The British Prometheus Co., Ltd., also announce that their London showrooms are now at 9, Newman Street, Oxford Street, W., where a large and comprehensive stock of specialities is held for the inspection of the trade.

Messrs. Graham, Morton & Co., Ltd., of Leeds, and R. H. Longbotham & Co., Ltd., of Wakefield, have amalgamated under the style or firm of Leech, Goodall & Co., Ltd., at Hunslet, Pepper Road, Leeds.

Messrs. Huth & Co., of Valparaiso, have been appointed by the General Electric Co., Ltd., sole agents for the import of "Osram" lamps into Chile, and they hold sole selling rights for that country.

British Rubber Trade in France.—According to the *Times*, the North British Rubber Co., Ltd., has purchased a fully-equipped india-rubber factory in Paris, to employ more than 1,000 hands when in full work. Operations are to be begun without delay. The company does a large trade with France, but it finds the development of this branch of the business difficult, owing to the tendency to increase tariffs. The duties on tires and other rubber goods have been increased by about 12½ per cent. under the new French tariff. Not many months ago the company decided to build a factory in Berlin.

An Old Osram Lamp.—On March 23rd, 1908, The General Electric Co., Ltd., sent us an Osram lamp of 200 Hefner c.p. for 200 volts, which we put on circuit in our publishing office. It has been in use all day on practically every working day since then, burning for about 48 hours a week, and we estimate that it has now had an active life of 5,000 hours on the Charing Cross Co.'s supply mains. It is showing signs of senile decay in the shape of a slight blackening; but in view of its record of faithful and efficient service, we are not disposed to cavil at a trifle like that. We are doubtful whether to give it a rest in a museum, or relentlessly to work it to death—we suppose that it *would* give up the ghost eventually.

Lamp Stealing Charge.—For stealing a number of Osram lamps and couplings, the property of his employers, Messrs. Johnson & Phillips, Ltd., Leeds branch, between February 1st and May 1st, Josiah Wilson, electrician, of Leeds, has been sentenced to one month's imprisonment. Mr. Crossley, manager of the firm at Leeds, said that stock had been handed to Wilson for use at Linton Springs, but he had left some lamps on sale at a shop in Victoria Road, Leeds. Examination of the Linton Springs stock disclosed a shortage of 22 lamps.

Camp Conduits.—The vitrified clay conduits known by this name, and widely adopted for drawn-in underground cables of all kinds—telephone, electricity supply and tramway feeder cables—in all parts of the world, are fully described, and their advantages are set forth, in an interesting pamphlet recently issued by Mr. W. Riley, of 30, Lime Street, E.C., who is the agent for the United Kingdom.

Canada.—Following up our recent notes on the Bergmann Co.'s plans regarding lamp business in Canada, we read in an American exchange that the Berlin company has been looking for a site in Ottawa of 40,000 sq. ft., with its own water and gas supply, whereon to begin with a tungsten lamp factory.

Reduction of Capital.—Robertson Electric Lamps, Ltd., and Reduced.—A petition for confirming a resolution reducing the capital of this company from £100,000 divided into 10,000 £10 shares, to £35,000 divided into 10,000 shares of £3 10s. each, was presented to the Court on May 6th, and is now pending. The list of creditors is to be made up as for July 4th, 1910.

Chile.—According to Reuter's correspondent at Santiago de Chile, extensive iron works have been established at Puerto de Corral, and plant is now being set up for the manufacture of steel plates, rails and other steel products.

Thermit Rail-Grinders.—Messrs. Thermit, Ltd., have received orders for two electrical rail-grinding equipments (Mattinson's patent grinder) one being destined for Sydney, Australia, and the other for the Paisley District Tramways.

LIGHTING and POWER NOTES.

Argentina.—According to the *Review of the River Plate*, a company has been formed in Olavarria with a capital of $200,000 to purchase the concession granted to Mr. A. Brumana for an electric light station and to work the latter.

Barnet.—The Guardians have decided to engage an expert, at a fee of £10 10s., to advise the Board as to lighting the workhouse with electricity.

Belfast.—Mr. Bloxam, the borough electrical engineer, reported last week that his department had made a net profit of £11,040 for the year ending March 31st, 1910, this being an increase of 33 per cent. over the previous year's result.

Bexhill.—At the meeting of the Council on Monday, a statement showing the financial result of the electric light undertaking for the year ending March 31st, was submitted. The gross income amounted to £10,244, and the expenditure to £5,157, the net profit being £5059, which is £100 more than in the previous year. A sum of £235 is allowed for depreciation, and after carrying out certain suggestions of the L.G.B., charging meters and public lighting extensions to revenue, there is an unappropriated profit from the last and previous years of £696 remaining. It was stated that the result would have been better if it had not been for the great delay in erecting the new condensing plant. For the first time the revenue had reached five figures, and of the increase of £470, only £45 was due to public lighting. Bad debts formed less than ⅓ per cent. of the total sum collected. The coal bill had been reduced by £115, although 60,000 more units had been generated. It is proposed to substitute high-power metal-filament lamps for the street arc lamps.

Birmingham.—At a recent meeting of the City Council, when authority was given for the provision of additional plant and the erection of a sub-station at Harborne, at a total estimated cost of £143,250, the chairman of the Electric Supply Committee, in moving the adoption of the estimates, said that for some years past the output had been growing by leaps and bounds, especially for lighting and power purposes. In 1907 the increase of units for lighting and power was 1¾ millions; in 1908, 2½ millions; in 1909, 3 millions; and last year, 4½ millions. The capital had been increased by about 15 per cent. and the output by about 50 per cent. During the three years, 1908-10, they had paid £20,000 in relief of the rates, besides £16,000 to the renewals fund and £12,000 for writing off obsolete plant. In addition to this satisfactory record, concessions to consumers in the way of reduced charges, amounting to about £11,000, had been made.

Blaby.—The R.D.C. has decided to favourably consider the request of the Leicester T.C. for consent to supply electricity in the Council's area. It is understood that the matter principally refers to the parish of Oadby, where a number of houses have been wired in anticipation of a supply being available.

Blair Atholl.—On Saturday last, the installation of the electric light in the village was inaugurated in the Atholl Arms Hotel, where 200 lights have been fitted up, and it is hoped that the whole village will be lighted in the course of a few weeks. Blair Castle, the residence of the Duke of Atholl, was lighted up by electricity several years ago, the dynamos being driven by water power, and the lighting of the village is the outcome of the Duke's desire that the villagers should share in the benefits. The cost to consumers will simply be enough to cover the interest on the initial expenditure.

Brighton.—The accounts of the Corporation's electric light undertaking for the year ended March 31st, 1910, have been published, and disclose a highly satisfactory result, inasmuch as there is a net profit of £6,252, as compared with £565 last year. The income of the undertaking has been £94,254 and the expenditure £43,037, which gives a "trading" profit of £51,217. The manager reports that the capital account stands at £800,753, as against £780,645 last year, the increase of £20,108 being chiefly due to plant, &c., at the Southwick Works and to the provision of new mains. There has been a decrease in the number of units used in private lighting of 148,926, owing to the extended use of the metallic-filament lamps, but there was a total net increased consumption of 1,044,133 units. The tramway output increased by 48,895 units. It is recommended that the whole of the surplus be transferred to the reserve fund.

Mr. Christie, the borough electrical engineer, has submitted a report to the T.C. to amend the charges for power in the case of persons having to use it in prohibited hours. He points out that at present they necessarily use an additional gas engine or motor supply if they want to secure the 1½d. rate, and this loses many customers. It has now been decided that a charge of 2d. shall be made for power used during prohibited hours, using a two-rate meter to register the power.

Continental Notes.—Turkey.—The Public Works Ministry has drawn up the regulations which are to serve as a basis for the granting of all future concessions for electric lighting, power and traction schemes. To facilitate the offers for, and the carrying out of, the various works, the Government has caused exhaustive data to be compiled of the circumstances prevalent in the different towns and localities. The presiding officer of each vilayet has been ordered to make thorough inquiries into the circumstances of his locality with a view to ascertaining the probable paying nature of any proposed schemes. These forms of inquiry have been returned, so that action can now be taken in connection with any applications or tenders already sent in. The value of these returns is very great, so far as prospective tenderers are concerned. Electric contracting firms would do well to apply to the Ministry of Public Works, Constantinople, for a copy of the several publications mentioned. Among other matters dealt with in these inquiry forms are the questions whether water power is available, and whether overhead or underground conduits are likely to meet with hindrances from the water supply or other systems in vogue; also the extent of public custom for light and power and the amount and frequency of the public traffic on electric street tramways.—*Elektrotechnik und Machinenbau.*

Germany.—The capital invested in electrical undertakings in the kingdom of Bavaria, it is officially stated, totals M. 200,000,000. In 1909 the output of the several electric undertakings amounted to 260,371 kw., of which more than half was utilised for the driving of machinery, two-fifths for lighting and the rest for cooking, heating, electro-medicinal, smelting and other minor purposes. For the generation of energy, water, steam and explosion motors were employed, sometimes singly, sometimes in combination. The power producers, including reserve motors, stood for a total of 275,872 kw. Of generating machines actually employed, the capacity totalled 190,414 kw. Steam was used as the principal generator of power in the ratio of 46·7 per cent. of the total. Water generation was under one-tenth, or actually 7·9 per cent. Water and steam, the latter being held as a reserve, stood for 29·3 per cent. Gas, benzene, spirit, petroleum, Diesel and other explosion motors were responsible for only 3·9 per cent. of the aggregate power generated.—*Elektrotechnik und Machinenbau.*

Spain.—A Royal decree under date of April 28th has sanctioned the expenditure of 7,500 pesetas for the acquisition and installation of machinery in the electrotechnic section of the Escuela Especial de Ingenieros Agronomes.

Holland.—The communal authorities of Middelbourg have voted a credit of £104 for the purpose of considering the question of the practicability of erecting a central electric generating station for the requirements of the town.—*Board of Trade Journal.*

Coventry.—During the last financial year the number of electricity consumers has increased from 1,133 to 1,293; the total units sold during the year amounted to 6,093,825, as compared with 4,559,105 in the previous year, being an increase of 33·6 per cent. The rental from sale of current, meter rents, motor rents, and lamp maintenance amounted to £36,908, and other receipts brought the total revenue up to £36,920. The working expenses amounted to £11,380, against £13,107 in the previous year, thus showing a gross profit for the year of £25,540, as compared with a gross profit of £17,499 in the previous year. This gross profit is 69·1 per cent. of the total revenue, and is the largest yet obtained by the undertaking, being equal to 10·6 per cent. of the total capital expenditure (averaged during the year). Owing to the increase in the total units sold, however, the capital costs per unit have been reduced from ·723d. to ·669d., a reduction of 15·7 per cent. The net result is a surplus for the year of £10,238, as compared with £3,765 last year. The committee makes the following recommendations as to the disposal of the balance of profit:—(1) That £2,500 be paid over to the general district fund in aid of the rates; (2) that £7,188 be paid over to the reserve fund, and transferred from that fund to capital account, and applied in payment of certain amounts, in lieu of raising the same by loan; (3) that £280 be paid over to the reserve fund, bringing the amount of that fund up to £3,000; (4) that £205 of the balance in hand be applied in the payment of a bonus to the employés in the department, and that the balance of £64 be carried forward to the next account.

Congleton.—The B. of G. is considering the advisability of having the workhouse lighted by electricity.

Dundee.—The revenue of the Corporation Electricity Department for the financial year just ended was £39 901, as against £36,974 for the previous year. The tramways, which consumed 2,402,282 units at 1½d., produced £11.260, and private lighting, 1,148,251 units at 3½d., produced £16.745. The expenditure side of the account shows a total of £21,478, leaving a balance to be carried to net revenue of £18,429, as against £12,046 last year. After meeting interest, expenses of loans, sinking fund, and depreciation and claim account, the balance carried to next year is £1,259, as against £1.256. The generation of energy absorbed £11,510, distribution £2,975, rates and taxes £5,128, and administration £1,864. The output from the stations during the year was 7,105,202 units, as compared with 5,988,161 last year. The estimates show a total revenue of £41,696.

Eccles.—A L.G.B. inquiry was held on May 26th into the application of the T.C. for a loan for E.L. purposes, made up of £842 for new buildings, £1,105 for additional plant, and £1,875 for mains extensions. There was no opposition, but the Inspector, Mr. H. R. Hooper, criticised the payment of 50 guineas as architect's fees for work of so simple a character, which could have been done by the Council's officials.

The borough treasurer has been instructed to transfer the amount of profit on the electricity undertaking for the year ended March 31st last, amounting to £1,206, to the credit of the capital account of the undertaking, towards the excess expenditure for which the L.G.B. refused to grant borrowing powers.

Folkestone.—The T.C. has decided to defer for seven years the question of purchasing the undertaking of the electric light company.

Grimsby.—The report of Mr. W. A. Vignoles, the borough electrical engineer, shows a satisfactory net profit of over £3,860 on the ninth year's working. This is about £700 more than in the previous year, and is the best result yet attained. The total units sold amounted to 2,350,869 or some 300,000 more than in the previous year, and included 501,321 units for tramways, 132,920 units for public lighting, 893,660 units for private lighting and power, 748,892 units supplied in bulk to the railway company, and 74,076 units supplied to the Admiralty. The profit on the year would have been better, but for a serious breakdown of an engine which increased the cost of repairs and coal. Owing to the reassessment of the undertaking, rates and taxes show an increase, and will do so more in the present year. Future profits will be largely affected by the loss of railway company's custom, the company having given notice to terminate its contract.

The Electric Lighting Committee of the T.C. has decided not to proceed with the proposed scheme of letting out lamps on the hire-purchase system. The Electrical Contractors' Association had objected on the ground that the scheme would interfere with direct sales by tradesmen.

Haslingden.—It was stated at the T.C. meeting on May 20th that the South Lancashire Electric Supply Co. was considering on what terms it could supply Haslingden with electricity in bulk.

Hawick.—The local police, on the recommendation of Major Ferguson, H.M. Inspector of Constabulary, are to be provided with electric instead of oil lamps.

Heckmondwike.—It was resolved by the Council on Monday, that subject to the sanction of the L.G.B. being obtained to the borrowing of the money, a tender be accepted for the erection of a condensing plant at a cost of £2,418.

Kettering.—For the year ending March 31st, 1910, the total revenue of the electricity department amounted to £8,602, and after meeting working and financial charges, a net balance of £444 remained; this is in addition to £250 spent out of revenue on capital items during the year. Some 788,109 units were sold for private and public lighting and power purposes, the maximum demand amounting to 577 7 KW.

Leigh.—The Electricity Department has made a profit of £112 on the year's working, as compared with £360 for the previous year.

London.—METROPOLITAN ASYLUMS BOARD.—At the meeting on Saturday it was reported that the actual cost of substituting metallic-filament lamps for carbon lamps at the Board's institutions amounted to £1,880 5s. The estimated cost was £1,921.

ST. PANCRAS.—The chief electrical engineer (Mr. S. W. Baynes) has reported to his committee at some length with regard to additional boiler plant at King's Road Station. The average yearly increased load during the past ten years was 350 KW, and he estimates that the demand fifteen years hence will have reached 9,871 KW. St. Pancras at present has two generating stations, but he had for some years foreseen the desirability of collecting the generating plant under one roof, hence the introduction of three-phase plant, and the opening up of sub-stations. He proposed so arranging that the generating plant at Regent's Park works should deal with the peak load only, and during the remaining nine months of the year it should be operated as a sub-station. For this purpose it would be necessary to install the following machinery:—At Regent's Park works—two motor-converters of 1,000 KW. each, with switchboards, &c., £5,900; three-phase trunk mains connecting King's Road with Regent's Park, £9,000. At King's Road—one spare turbo set, £9,400. Total, £24,300. Ducts had been laid during the past year along the Hampstead Road portion of the route. The economies to be obtained by the foregoing arrangement would be considerable, but these economies could only be brought about by the extension of the boiler plant at the main generating station, King's Road. With regard to the latter, he submitted two schemes. The first took into account a prospective load of 9,800 KW. 15 years hence, and he thought that a boiler house 180 ft. long × 77 ft. wide would accommodate eight water-tube boilers and two superheaters, sufficient to operate such a load. The present boiler house and plant would provide the spare boilers. He estimated the capital outlay on this scheme as follows:—Buildings, including chimney shafts, flues, &c., £18,200; four boilers and superheaters, coal conveyor and ash handling plant, pipe work, pumps and all accessories, £29,370; extra lengths of pipe work, £932; extra length of coal transporter, £2,500; total, £51,002. The total annual expenditure under this scheme would be £4,744. The second scheme, while demolishing the dust destructor and buildings, would also involve the pulling-down of the old boiler house and the removal of the Lancashire boilers. The capital outlay for this scheme would amount to £84,549, the chief items being:—Buildings, chimney shafts, flues, &c., £18,200; four boilers, superheater, conveyor and ash handling plant, £29,370; cost of dust destructor, £19,354; land for ditto, £10,750. The annual expenditure under this scheme would be £6,225. He estimated that with the new boiler works the costs would be reduced from 1·02d. per unit sold to ·69d., for 9,000,000 units, and would save in one year £12,375, and altogether he anticipated an immediate return of 11 per cent. on the capital invested after paying sinking-fund charges at the higher rates now imposed by the L.C.C. In conclusion, Mr. Baynes said that much as the boiler plant was needed, he would not recommend a brick to be laid until some satisfactory working arrangement had been made with the Midland Railway Co., so that there would be direct means of running the coal into the Council's works. There was a capital site now available with an elevated railway siding right in, and the line was not that of the Midland Railway Co. A Special Committee is to be appointed by the Council to consider Mr. Baynes's report in detail.

New Zealand.—A Bill has been carried authorising the Auckland City Council to raise a loan of £225,000 for the extension of the city electrical undertaking.

Pakefield.—A private company has solicited the support of the Mutford and Lothingland R.D.C. to an application for a prov. order for E.L. at Pakefield. The company has already obtained a decision not to oppose such an application, from the Lowestoft T.C. The R.D.C. has referred the matter to the Parochial Committee.

Porlock.—An electric lighting company has been formed at Porlock, Somerset, a picturesque little town in the heart of the stag-hunting country. The adjoining village of Porlock Weir, on the Bristol Channel, will be connected. Messrs. J. and W. Parves, of Exeter, are the consulting engineers.

Preesall (Lancs.).—The U.D.C. has been approached by an electrical engineering company at Leigh, soliciting support for an E.L. scheme for the district without obtaining Parliamentary powers. The Council has replied to the effect that it has a scheme under consideration.

South Africa.—TRANSVAAL.—An important report from Mr. F. Saunders, consulting electrical engineer, was considered by the Klerksdoorp T.C. on April 8th, containing three proposals for supplying the town with electric light. The scheme chosen by the Council will cost about £9,500, and the Transvaal Government's sanction will at once be sought for raising the necessary funds.

NATAL.—Considerable growth has taken place in the demand for power and lighting at Durban. During the past month preliminary inquiries have been made for about 1,000 H.P., of which at least one-half is almost certain to be wanted, and if this growth is likely to continue, there will have to be considerable reorganisation in the present methods of supply. Already several contracts have been placed for extensions of cable to meet the demand. Negotiations are also in progress for supplying the Natal Government with power in bulk, and if such is brought about, there will be very considerable extensions at the power station.

Sunderland.—At a meeting of the T.C. on May 25th, a recommendation by the E.L. Committee that 266 existing gas lamps on the route of the electric cables should be converted to electricity was adopted.

Walthamstow.—The following revised scale of rents for meters is to come into force as from the end of the March quarter:—5 amperes, 1s. per quarter; 10 amperes, 1s. 6d.; 25 amperes, 2s. 6d. The electrical engineer and accountant are to be authorised in future to arrange the prices to be charged for the purchase of any installation which has been fitted up under the free-wiring scheme, the price to be arranged by estimating the present value of the installation or by adding interest at the rate of 5 per cent. to the original cost, and making an allowance for the amounts paid as rental since the installation was connected. Payment is to be spread over two years if desired, interest being charged at 5 per cent.

Watford.—A L.G.B. inquiry was held on May 26th into the application of the U.D.C. for a loan of £7,500 for E.L. purposes; opposition was offered by counsel on behalf of the Trades Protection Society, who demanded that in future no preferential

rates should be given to contractors and others, and that the charges in any case should at no time be less than that charged the public for street lighting.

West Bromwich.—The annual report on the Corporation's electric light undertaking shows that the total income from the sale of current for all purposes amounted to £12,663; the total number of units sold for all purposes was 2,010,608. The gross profit for the year amounted to £6,349, and the net profit to £1,756.

Willesden. — The electrical engineer has been instructed to report in regard to the number of private arc lamps in the district, also the cost of purchase and supply of current under the old and new agreements with the North Metropolitan Electric Power Supply Co. The Electricity Committee has decided in favour of the Council undertaking the sale of certain apparatus such as electric irons, kettles, &c., with a view to augmenting the general demand for current and improving the load factor. It is further proposed that the manager of the electrical exhibitions be allowed a commission of 2½ per cent. on all sales effected by him. The prices are to be fixed at the usual trade selling figures.

Wimbledon.—Negotiations are proceeding with the Foster Arc Lamp and Engineering Co., Ltd., for the granting of a site to the Council for an electric transformer station at Merton; the cost of the station, including the laying of supply mains and service cables, is estimated at £416. The Anglo Engraving Co., Ltd., has offered to guarantee a minimum consumption of 20,000 units per annum, if a uniform charge of 1d. per unit for all energy supplied to its factory in Kingston Road is made; this has been accepted. The L.G.B. is to be asked to sanction the borrowing of £800 for meters. On and after June 25th the ordinary lighting rate is to be charged for energy supplied to the various departments of the Council for lighting purposes. Previously 2¾d. per unit was charged.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—For the period from June 1st, 1909, to May 25th last, the Corporation tramway receipts aggregated £69,032, or £567 less than the total for the corresponding 360 days of the previous year. In all 16,041,747 passengers were carried, and 1,557,397 miles run. The allowances to the Suburban Tramways Co. amounted to £1,733.

Blackburn.—Mr. J. H. Cowell, manager of the tramways, has issued his report of the year's working, showing that there is a profit balance of £453. The traffic receipts (£55,612) are £917 less than last year, which is attributed to bad trade.

Continental Notes.—Austria-Hungary.—According to the *l'Industrie Electrique*, the Oesterreichische Länderbank and the Union Bank have decided to provide the funds required to convert the urban railways of Vienna to electric traction. The work will be executed by the firms allied with these banks—namely, the Oesterreichische Siemens-Schuckertwerke and the electrical department of the Union Bank.

An electric tramway is to be established inthe town of Reichenberg, Bohemia.

Plans are being prepared in respect of a projected electric tramway in the town of Szolnok.

Spain.—A company has been formed in Brussels, with a capital of 7,000,000 fr., styled the Tranvias Electricos de Barrits-San Sebastian-Tolosa, with the object of building and working railways, tramways, and similar undertakings.

Germany.—The Wurtemburg Government has recently granted a concession for the construction and working during a period of 90 years of an electric tramway between Oberesslingen and Oberturkheim.

Dartford.—The U.D.C. has asked the lessees for the light railways to renew the lease of the undertaking for another five years.

Dundee.—Mr. Peter Fisher, the tramways manager, who had been asked to report upon the adoption of a universal 1d. fare over the system, submitted to the Council at the last meeting an analysis of the fares received from passengers for the last completed working year. Halfpenny fares for the year numbered 4,887,145; 1d., 10 781,912; 1½d., 739,780; 2d., 259,288; workmen's (return fare), 330,258; making a total of 16,988,331 fares. If the 1½d. and 2d. fares were abolished, and a universal 1d. fare adopted, the result would be a loss of £2,621. The adoption of the all-round 1d. fare would not have the effect, perhaps, of decreasing the revenue, since the ½d. fare would also be abolished; but to his mind, the real question was whether a reduction of 50 per cent. to 260,000 passengers and a reduction of 33 per cent. to 740,000 would be of such public benefit as to warrant the raising of the fares by 100 per cent. to several millions of passengers. It was thereafter moved that the fares remain as at present, and this was carried by 4 votes to 3.

The Corporation Thamway Committee has agreed to insure against third-party risks, and to recommend that the offer of the British Union and National Co. of £389 per annum be accepted. It was suggested that the department should be its own insurers. Mr. Fisher, the manager, said that with such low premiums offered, he was in favour of insurance.

Edinburgh.—The first Corporation electric car has had a trial run on the new line between Slateford Road and the Markets. The car was made in the tramway company's works at Shrubhill.

Huddersfield.—On Friday, last week, a settlement was arrived at of a protracted dispute between the Corporation and Linthwaite Council with respect to the relaying of the tramway track from the Huddersfield boundary at Pinfold on the Manchester Road, through Linthwaite to the boundary of Slaithwaite. At the conference it was agreed that the Linthwaite U.D.C. should sell to the Corporation the tramway track for £4,000, on condition that the Corporation relays the track with double lines. The question of outstanding contracts entered into by the Linthwaite Council with respect to the track was also settled satisfactorily.

Japan.—The Japanese Railway Board is reported to have decided to lay a third rail beside each of the tracks of the railway between Tokio and Yokohama, so that it will be possible to run trains of either the old 3 ft. 6 in. narrow gauge or the 4 ft. 8 in. gauge over the system. The trains on the standard gauge will be operated electrically, the necessary power being obtained from the generating station of the Tokio Railway.

Liverpool.—At a meeting of the Tramways Committee on Friday last, it was reported that the first-class cars on the Pierhead and Croxteth Road route, which had been running some months, were earning on an average 13·10d. per mile, against 11·14d., the average of the ordinary cars. It was decided to institute a 10-minute service of first-class cars on that route, and also to comply with a request for first-class cars on the Smithdown Road route.

Middlesex.—At the meeting of the C.C. on May 26th, the county engineer was authorised to engage to September next such necessary temporary assistance as he may consider desirable in connection with light railway schemes at a cost, including clerks of works, of £700. The Tramways Committee has decided to abandon the proposed application to the Light Railway Commissioners this year in regard to the suggested line from Cricklewood to Netherwood Street. The Committee states that it intends to continue negotiations with the L.C.C. and the Willesden U.D.C., and hopes to be in a position to present a satisfactory scheme to the Middlesex C.C. in due course.

Paisley.—The Paisley and District Tramways Co. has commenced the formation of a new line, four miles in length, which will connect the present terminus at Barrhead with Rouken Glen, the present terminus of the Glasgow Corporation system. The scheme, which will cost about £40,000, will be completed in August. The Clyde Valley Co. will supply the electric power.

Richmond.—At a special meeting of the T.C. on May 27th, it was reported that the directors of the tramway company had notified that they could not see their way to construct a double line of tramways in the Kew Road. They proposed that the route be constructed as a single line with the necessary passing places, within the extended period of 12 months, or in the alternative that the existing horse tramway with powers to reconstruct be sold to the Richmond Corporation. The company agreed not to adopt any overhead system of traction, and the directors added that if these proposals were accepted, they would render unnecessary the road widenings at present contemplated, and would decrease the cost of construction. The Council decided to agree to an extension of time for one year for the construction of the tramway with a single line as proposed, provided that the company shall widen the road so as to leave a space of not less than 9 ft. 6 in. between the outer rail of the tramway and the kerb or edge of the footpath on both sides of the road. If the company does not commence there construction before September 30th next, the Council will have the option of giving the company three months' notice to purchase the undertaking.

Salford.—Portions of the tramway track are to be relaid during the ensuing 12 months at an estimated cost of £13,000.

South Africa.—Cape Colony.—On the recommendation of a special meeting called for the purpose of considering the reconstruction of the East London tramway track, it was agreed that two sections be relaid at an estimated cost of £2,500, and that there be a new track laid including provision of crossings, at an estimated cost of £9,962.

Transvaal.—The Municipality of Germiston has under consideration proposals for the establishment of an electric tramway scheme, and applications are invited for a consulting electrical engineer to report on the scheme and prepare, if necessary, all plans, &c.

The last statistics of the Johannesburg tramways show that 1,958,588 passengers were carried during the month of March, and resulted in £26,169 revenue, being an increase of 263,857 and £3,726 respectively upon the figures of March last year. Taking the whole of the nine months, the receipts totalled £210,464, as against £179,960 for the corresponding period of last year, while 15,837,162 passengers were carried, as against 13 688 922; also during that period the receipts per car-mile have risen from 2s. 4·85d. to 2s. 10·43d.

Stockport.—The Tramways Committee is considering a suggestion by the Cheadle and Gatley District Council that letter-boxes should be fixed to the cars running through the rural district between Stockport and Gatley, for use in the evenings. The idea was favourably commented upon by the Stockport Councillors.

Stretford.—Information has been received that Mr. Buckmaster, K.C., the arbitrator appointed by the B. of T. in the dispute between the Manchester Corporation and the Stretford Council with regard to the supply of energy for tramways, has given his award in favour of the Corporation. The question was whether Manchester could call upon Stretford to supply an abnormal demand caused by the football traffic. To meet the growing demand the electricity station at Longford Bridge has been extended, and the Council at its last meeting accepted the tender of the General Electric Co., for a 500-KW. steam-driven generator to cost £2,764, and a spare armature to cost £325. On the occasion of the opening of the new football ground the maximum load was 1,176 KW., and the additional number of cars run was 60. The increased consumption was 1,100 units, which at 1½d. per unit amounted to £5 14s. 7d. A meeting of the Council's Electricity Committee is to be held shortly to consider the award in detail.

Sunderland.—Mr. A. R. Dayson, the manager of the Corporation tramways, has just issued his annual report on the working of the system. It states that the total revenue was £58,545, and the expenditure was £37,216. Of this latter amount traffic expenses were £17,297, general expenses £5,647, repairs, &c., £3,705, and power expenses £10,564. The gross profit was £21,575. Of this £7,847 went in interest, and there was a balance to the appropriation account of £13,160 Out of the latter sum there was spent on the repayment of loans £10,092, and reserve and renewals £2,444. There was a net balance of £3,588, and of this £2,963 was placed to the reserve and renewals fund. Since the cost of energy had been reduced from 1¼d. to 1½d. per B.T. unit, the account had been reduced by £1 867 on the previous year. The reserve, renewals and compensation fund now amounts to £27,754. The average cost of working per car-mile was 6·11d., and, excluding power cost, 4·37d.

Wigan.—The Tramway Committee has decided to obtain the expert advice of Mr. Mallins, general manager of the Liverpool Corporation Tramways, who will inspect and report upon the whole of the Wigan undertaking. For some years there has been a financial loss.

TELEGRAPH and TELEPHONE NOTES.

Brazil.—New telegraph lines 7,000 km. in length are, says *Elektrotechnik und Maschinenbau*, to be established by the Brazilian Ministry of War and Public Works through the tropical northern provinces of Brazil. The first line will be set up between the capital and seaport of Sao Luis, in the Province of Maranhao, and Goyaz, the capital of the province of the same name. It will have a length of 1,900 km. The other lines will intersect the Provinces of Amazonas and Matto Grosso, and extend to the frontiers of Ecuador, Peru and Bolivia, and will have a total length of at least 5,000 km. All the necessary material for the equipment of these lines must be procured from Europe or North America, affording an opportunity for securing some good orders.

Cable Compact.—The rumour that the Commercial Cable Co. had formed an alliance with the Anglo-American Telegraph Co. has been emphatically contradicted by Mr. C. H. Mackay, president of the former company.

Cape Colony.—The telegraph line between this colony and German South-West Africa has now been completed and is open for public service. The charge for messages is at the rate of 3d. per word.

France.—For the purpose of establishing a municipal telephone service in the 14 communes in its circuit, the Chamber of Commerce of Moulins, department of the Allier, has been authorised to lend to the State the sum of 174,290 fr.; and a like authorisation has been accorded to the Chamber of Commerce of Chartres, Eure-et-Loire, for a sum of 104,053 fr., to establish telephones between Chartres and Tours, Maintenon, and Nogent-le-Roy.

Long-Distance Telephony.—Speech was recently transmitted successfully between Paris and Sundsvall (north of Stockholm) with the strong-current microphone of Messrs. Egnér and Holmström. The distance covered was 2,270 km.—*E.T.Z.*

Municipal Telephones.—At the annual conference of the National Chamber of Trade at Bradford last week, the "fixed policy" of the Chamber in favour of municipal administration of the telephone service, as against State control, was further advocated, and it was stated that the Government was at present committed to neither policy—though it has bought up some of the municipal telephone undertakings. The Telephone Committee stated that the average cost per station throughout the National Telephone Co.'s system was £30; in the local areas served by the Post Office, £52; and in the municipal area of Hull, £21; showing what might be expected from State as compared with municipal administration. Commenting on the report of the Committee, the retiring president severely criticised the Government management of the trunk service, and said that what could be done at Hull could be done at any other town.

Uruguay.—A concession has been granted to Don Antonio Rossi for the establishment of a telephone service at Villa del Carmelo (Department of Colonia).—*Board of Trade Journal.*

Wireless Telegraphy.—It is stated that the French military authorities in Central Africa have recently made a great advance in telegraphic communication by the establishment of wireless stations at Port Etienne, which is the most northern port of Mauretania, and at Dakar. By means of apparatus which has been improved by those in charge of the Eiffel Tower station under the superintendence of Commander Ferrié, it has been found possible to transmit messages between Paris and Port Etienne, Paris and Dakar, and between Port Etienne and Bizerta, which are 2,418 miles, 2,790 miles, and 2,090 miles respectively apart. The connection between Port Etienne and Bizerta is effected right across the Sahara, the influences of which produce special difficulties. The stations at Port Etienne and Dakar are each controlled by an officer of the colonial infantry. It is not known definitely whether Casa Blanca, which is still occupied by French troops, has been used as an intermediate station on the route between Paris and Port Etienne, but it is very probable that this is the case. The General Governor of French West Africa will soon erect a station at Timbuctoo, which will be followed by similar stations at all the large ports within his province, the former to be in communication with the existing stations at Oran and Bizerta; and the extension of the system to Lake Chad and the French Congo will only be a question of the near future. It is considered that the bringing of Timbuctoo into the sphere of wireless telegraphy will largely advance the value of the French possessions in Central Africa, and that the connections between Paris and Dakar and between Bizerta and Paris would also afford important advantages in the case of war by closely uniting the two African naval bases to the Mother Country.

A conference was held at Newcastle last week to consider the extension of wireless telegraphy on the North-East Coast; Commander Loring, Inspector of Wireless Telegraphy, attended on behalf of the Post Office, and stated that the Department did not desire to make a profit from the establishment of a wireless station, but wished to be guaranteed against loss.

The Marconi Co. has obtained the sanction of the French Government to the erection of a station at St. Lazaire, and has agreed with the Spanish Government to take over stations erected by Spanish companies at Cadiz, Teneriffe and Las Palmas, besides constructing new stations at Cape Finisterre, Barcelona, the Balearic Islands and other places on Spanish territory.

The new N.S.W. Institute of Wireless Telegraphy has elected Mr. F. Leverrier as president; Mr. W. H. Hannan is hon. secretary.

It is reported that the ss. *Idaho*, equipped by the United Wireless Telegraph Co., on her first voyage exchanged messages with stations 1,680 miles distant.

The Midland Railway Co. has equipped its steamers on the Irish service, and its station at Heysham Harbour, with wireless apparatus on the Lodge-Muirhead system.

Wireless Time Service.—The official transmission of "the right time" to ships at sea, as well as to land stations, from the Eiffel Tower was commenced at midnight on May 24th. The signal is made at the hour exactly, and is repeated at two and four minutes past the hour. The range of transmission is estimated at 4,000 or 5,000 km.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—BRISBANE.—June 22nd. Deputy Postmaster-General. Copper wire, insulators, battery material, &c. Local representation. Deposits may be paid at the High Commissioner's Office, 72, Victoria Street, S.W.

S. AUSTRALIA.—July 6th. Cordless switchboards for the P.M.G.'s Department in South Australia. See "Official Notices" May 20th.

VICTORIA.—July 19th. 4,200 Commonwealth telephone sets, for the P.M.G.'s Department in Victoria. See "Official Notices" May 27th.

MELBOURNE.—June 8th and 17th. (*a*) 1,470 opalescent arc lamp globes; and (*b*) arc lamp carbons, for the City Council. See "Official Notices" May 27th.

Barnes.—June 14th. Low-tension triple-concentric cable for the U.D.C. See "Official Notices" May 20th.

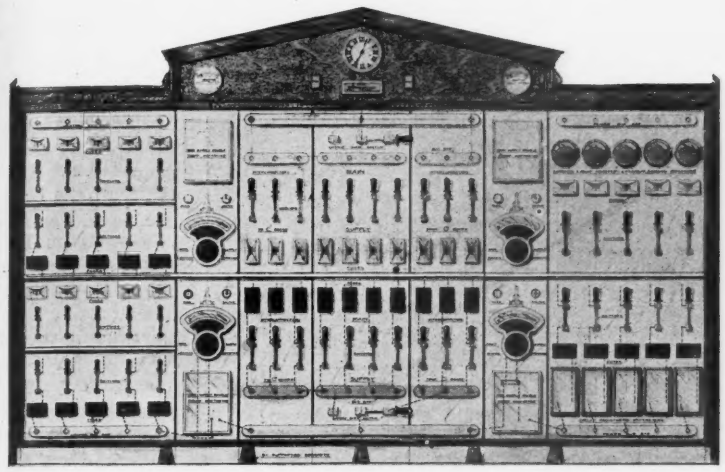
Belfast.—June 13th. Electric lighting installations in the new asylum buildings on the Purdysburn Estate, for the Committee of Management of the Belfast District Asylum. Specifications 10s. (returnable), from Messrs. Watt, Tulloch & Fitzsimons, 77A, Victoria Street, Belfast.

(*Continued on page* 919.)

THE ELECTRICAL EQUIPMENT OF MESSRS. EDWARD LLOYD, LTD.,

SALISBURY SQUARE, LONDON, E.C.

While the surpassing merits and advantages of electricity for lighting, heating, and even in some cases for power, are not unchallenged, there is one department in which she reigns supreme and unapproached—the driving of modern printing machinery. The huge newspaper presses of to-day, running at high speed and under extreme stress of urgency, demand a system of control which finds no parallel in any other application of motive power with which we are acquainted, and which cannot be provided by any other motive agent with anything even remotely comparable with the efficiency, adequacy, reliability and convenience of the electric drive. Of this fact, as well as of the extraordinarily wide range of utility of electricity in a printing establishment, there could hardly be a more striking example than the equipment of Messrs. Edward Lloyd's huge plant, on which nearly 1½ million copies of *Lloyd's Weekly News* are printed for each issue, in addition to the *Daily Chronicle*, *Westminster Gazette*, &c.



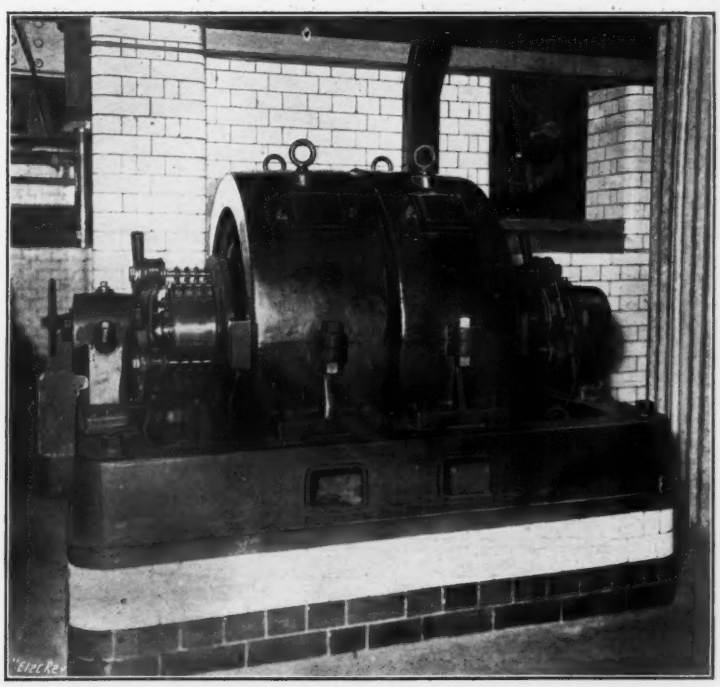
One of the Three Main Switchboards.

There are in this establishment about 150 motors, of powers from ¼ H.P. to 160 H.P., and aggregating 2,500 H.P., all supplied with energy from the City of London Co.'s mains, as well as an electro-plating outfit, electric fire-alarms, bells and telephones, and a large installation of inverted arc lamps, mercury-vapour lamps and glow lamps. A short description of the electrical equipment can hardly fail to be of interest to our readers.

The company's mains are brought into the building at three different points, to ensure continuity of supply, and are connected to three large switchboards, each measuring about 17 ft. × 11 ft. high. The main cables are paper-insulated and lead-covered; the circuits are wired with rubber-insulated cables in steel conduits. All fuses on motor circuits are confined to the main switchboards, though circuit-breakers are provided at, or near, the motors. The three switchboards can be connected together through heavy throw-over switches on the outers of the three-wire system, the neutral being permanently coupled up. Each switchboard is fed through four 0·5 sq. in. cables, and the main ammeters read up to 2,000 amperes on each outer; the instruments are mainly of the central-station type with illuminated dials, and the fuses are of the Peard type, which has been found very satisfactory. Large Aron double-tariff meters are provided on the main supply circuits, and maximum-demand indicators and watt-meters are inserted in the motor circuits, so as to keep a check on the condition of the motors and machines.

A special feature in the design of the switchboards, which consist of marble slabs, is the absence of vertical members of the supporting framework; the horizontal angle-irons are embedded in the wall at either end, and the main bus-bars are also horizontal, so that the risk of short-circuit is eliminated, especially as the ironwork is encased in marble. Each of the switchboards is erected in a separate switchroom with glazed partitions; there is no space to spare in front of the board, but care has been taken to provide ample room at the back, where it is more necessary for safety.

The lighting circuits are controlled from one end of the main boards, and the power circuits from the other. Most of the lighting in the large composing rooms and press rooms is effected with inverted 10-ampere arc lamps of the Union Co.'s make, provided with large reflectors of, roughly speaking,



Motor-Generator for the Geipel & Lange-Mascord System.

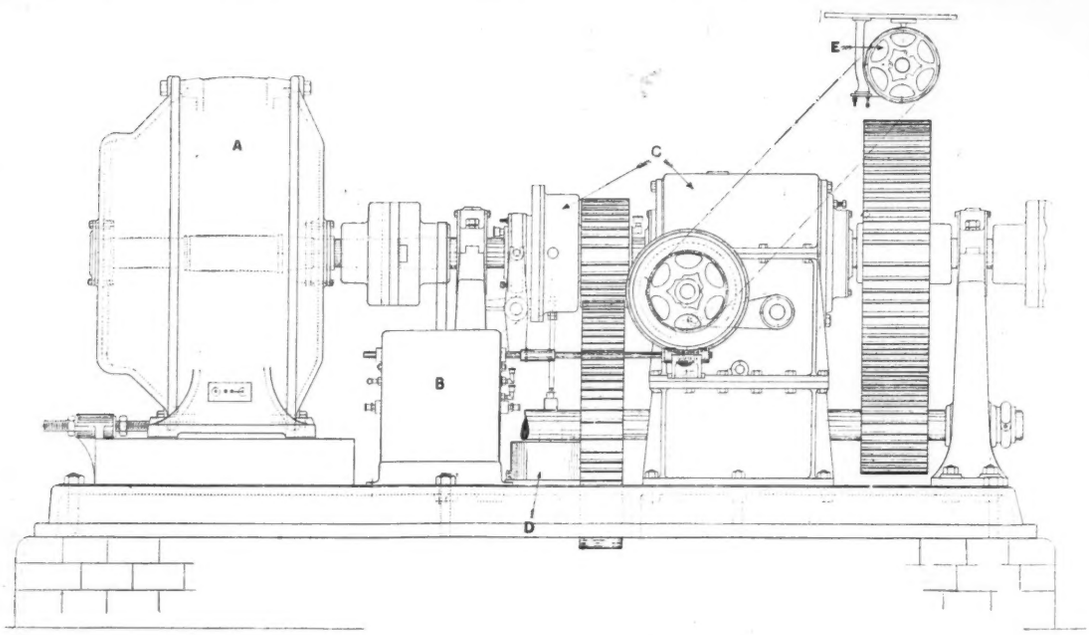
saucer shape, which can be more readily kept perfectly clean and white than the ceiling, and ensure an exceptionally good light where it is needed. One of the Linotype composing rooms is lighted with 16 Cooper-Hewitt mercury-vapour

lamps, which give an exceedingly effective light for the purpose, in spite of its peculiar tint. Both the arc and the mercury-vapour installations afford remarkably good examples of efficient lighting, the effect being greatly aided by the white enamelled walls and white ceilings. Glow lamps are used for local lighting, often with specially shaped reflectors to direct the light into the great presses and to shade it from the eyes.

Controlling Apparatus for a Double Geipel & Lange-Mascord Driving Equipment.

The principal features of the power installation are, of course, the motors and controllers for driving the presses. There are in the building seven double octuple perfecting machines, each capable of producing 55,000 copies per hour of a 32-page paper, when working from eight rolls at a surface speed of 800 ft. per minute, and weighing about 120 tons. There are also one octuple, one sextuple, five double supplement, two three-roll (working as one six-roll) and two rotary bill presses. In conjunction with these there is, of course, a great variety of auxiliary machines and tools. To begin with, there are 41 Linotype machines, each driven by a ¼-½ H.P. motor, except in the *Chronicle* composing-room, where a number of the machines (those first installed) are driven from a line shaft, with a motor at each end; these motors are used alternately, either being capable of taking the whole load. Motor-driven fans exhaust the foul air from immediately over each Linotype machine (except in one room where natural draught is employed) and propel fresh air through trunks into the upper parts of the room for general ventilation. High-pressure gas is used to heat the type-metal on the Linotype machines and the 2-ton stereo metal pots, and a motor-driven compressor is installed as a stand-by, to compress the low-pressure gas if the high-pressure supply should fail. "Copy" is transmitted from point to point by pneumatic tubes, of which there is a very complete installation, actuated by a Roots blower with an 8-H.P. motor.

The formes are conveyed from the composing room to the stereotyping department by a special forme lift, of the automatic push-button type, constructed by Messrs. J. G. Childs & Co., Ltd. As it was essential that the



A, Variable-speed motor; B, Electrical controller; C, Clutches; D, Clutch controller; E, Drum controller.

Elevation of Mechanical Driving Gear, Mascord System.

table of the lift should be perfectly level with the stone, it was found necessary to provide fixed stops to determine its position absolutely; as the motor could not be stopped with equal precision, springs were inserted in the connection between the ropes and the cage, a device which acts perfectly. A rising door has also been added, which automatically closes when the table is not in position, and thus renders it impossible to slide the forme into the empty lift shaft.

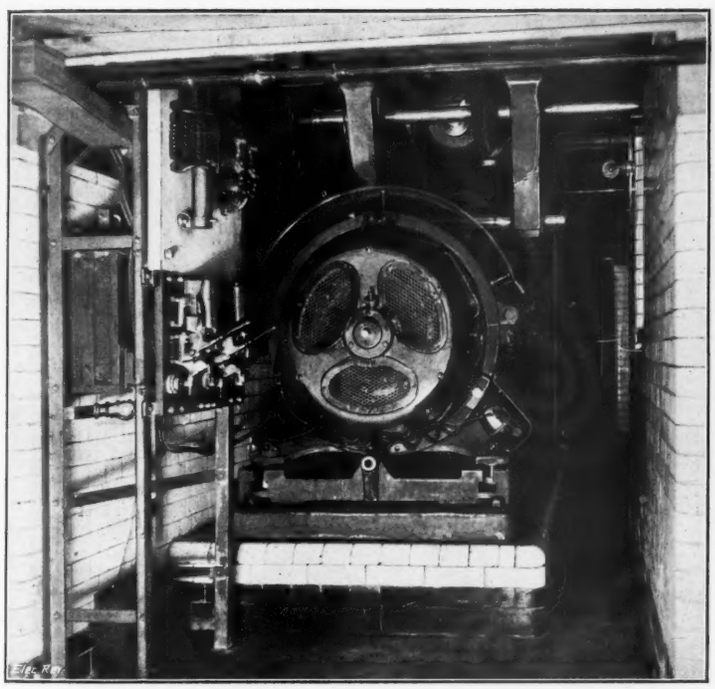
There are eight casting-box cutting-off saws, driven by 1-H.P. motors, several boring machines for stereo plates, with motors of 2 to 4 H.P., and planers of various types. The plate lift by which the plates are sent down to the machine room operates by gravity in the downward direction, a 2½-H.P. motor with a free-wheel attachment being provided for the reverse movement. Two guillotines and a re-reeling machine are also motor-driven.

In the photo-process room Angold enclosed arc lamps are used for photography, the automatic etching bath is oscillated by a ½-H.P. motor, and the router is driven by a small motor with vertical shaft running in ball bearings. In the nickel-plating department, where the half-tone process blocks are given a nickel face, a 6-H.P. motor-generator is installed, giving current for the baths at about 5 volts.

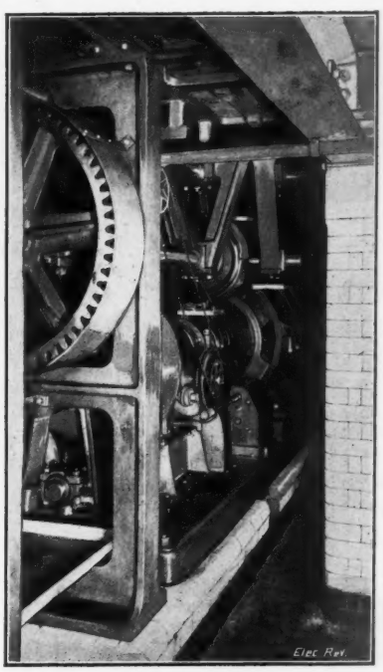
stop. When the presses are run, as usual, as double octuples, the combination is controlled from either controller singly. Beside each controller there is an emergency stop push-button, and similar stops are provided at two places on each machine.

The Ward-Leonard system, as modified under the joint patent of Messrs. Geipel & Lange and Mr. Mascord, makes use of a 30-H.P. motor-generator, and a 75-H P. driving motor, to each machine, together with a solenoid-operated field-controller, starting switch for the motor-generator, rheostats, circuit-breakers, signal lamps, &c. The whole of one of these controller equipments is shown in the accompanying illustration, page 908, providing for the control of both sections of a double octuple press.

The solenoid controller will be seen in the foreground, mounted on the top of the corresponding rheostats. When the small controller in the machine room is turned, one or other of the solenoids is actuated so as to move a core carrying brushes, which gradually vary the fields of the motor and generator by cutting resistance in or out of circuit. To begin with, the main motor field is saturated, and the generator voltage is zero, the brushes of the latter being joined directly to the terminals of the motor. When the



Chitty Motor Driving Press through Mascord Gearing.



Mascord Transmission Gear, under Press.

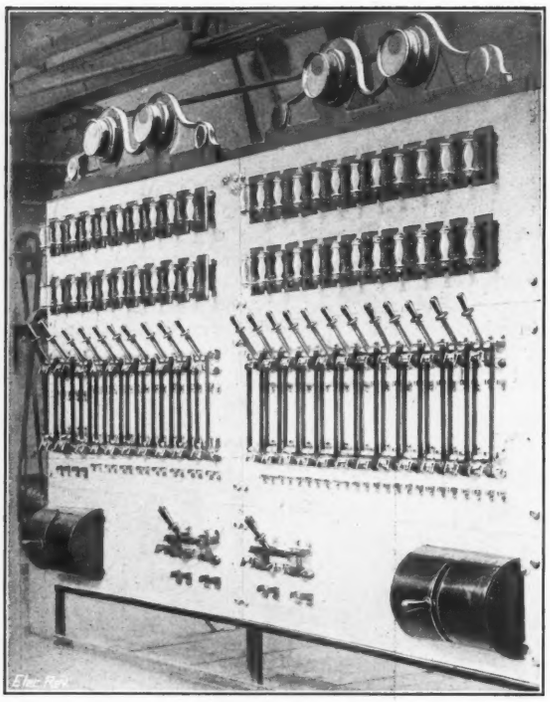
We come now to the main machines. The two three-roll presses are driven by Holmes-Clatworthy equipments, the main motors being of 40 H P. each. The motors are mounted in a room over the press-room, and drive vertical shafts through bevel gear; as the machines are commonly used together as one 6-roll press, the two motors are mechanically coupled (when desired) by a horizontal shaft geared to the two vertical shafts through rawhide bevel wheels. Each motor, of course, has its own motor-driven controller, and these are also coupled, when necessary, by a cross shaft and by switch gear. It may be noted in passing that all such auxiliary switch-boards are enclosed by roller-shutters when not in use. All the bevel gear shafts above-mentioned run in roller bearings.

For driving the big double octuple presses, each requiring two 75 or 90-H.P. motors, two methods are in use, one an electrical system, based on a modification of the well-known Ward-Leonard system, and the other a mechanical device invented and patented by the mechanical superintendent, Mr. G. W. Mascord, which enables the same result to be obtained with one motor as the former with two motors and a generator. In either case the control is the same—a very small master controller fixed near each octuple machine, and giving every motion, from inching round to full speed or

controller is moved to start the machine, the generator field is excited, causing the motor-armature to be fed at a low voltage, which is increased by small steps to a maximum of 210. The field of the motor is then weakened to a normal value, increasing its speed. Next a throw-over switch automatically connects the motor to the mains, with the generator at 210 volts, working in opposition to the supply pressure at 420 volts; and lastly, the generator field is gradually reduced to zero. In the final full-speed position, therefore, the main motor is supplied at 420 volts from the mains, through the armature of the generator, whose field is unexcited. The whole operation of running up to full speed is effected in 25 seconds, the maximum travel of the solenoid switch being 4 in. Inching round is effected with the generator at very low voltage, the regulation being produced by acting on the generator field. The speed of the motor driving the press is set at any required value according to the work in hand by limiting the traverse of the switch by a stop screw, which is accessible only to those in charge of the plant.

Close by the controllers in the machine room there is a balancing board for the two sets, with which the load on the motors can be equalised when, as usually, they are driving

the presses in parallel. Signal lamps show when the presses are coupled, when the motor-generators are running, and when the press motor is at rest and dead. Ampere and volt-meters are provided, balancing switches, reversing switches, and four-point inching switches. The last-named are



"COUNTRY LIFE" PRINTING OFFICE: MAIN SWITCHBOARD

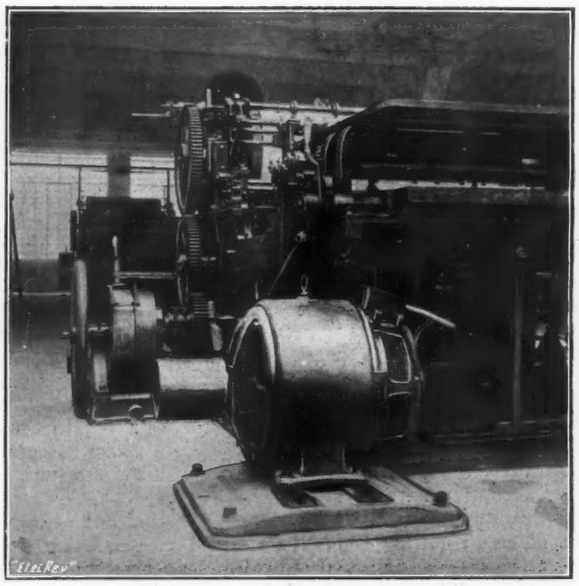
required on account of the varying starting effort required by the press, according to the size of the newspaper being printed. The static friction with a large paper requires a correspondingly large "kick-off," though, once in motion, a much smaller torque can keep the press moving.

The mechanical driving system developed by Mr. Mascord is shown in our other illustrations. The principle upon which it works will be gathered from the drawing, page 908; the motor, which runs at full speed (except for a certain range of shunt field regulation, which amply provides for the requirements) drives the press through one or other of two Hele-Shaw clutches; the smaller, nearer the motor, couples the armature shaft to a double-reduction gearing giving a speed ratio of 20 : 1; thus, with this clutch in, the motor running at 400 R.P.M. drives the press cylinders at 10 R.P.M. through the gearing. Whilst inching is going on, this clutch is being actuated by the master controller. When the order is given to run up to speed, the small clutch remains in until the gearing is running at the full speed of the motor, when the large clutch automatically engages the armature shaft with the main shaft, and the small clutch falls out of action. The gearing is fitted with a free-wheel device, so that when the change-over takes place it becomes idle and stops, leaving the press directly driven by the motor. This system of driving, which has been applied to four of the double-octuple presses, has been found to answer all requirements. It is electrically controlled by a device contained in the casing near the motor, which is supplied with power by a small belt from the latter. The field regulating apparatus is driven from this through a worm and wheel, as indicated. Our illustrations on p. 909 show the mechanical transmission gear between two of the columns supporting the floor of the machine room, and the main motor. Not the least of the advantages of the electric drive thus arranged is that it can be stowed away under the presses, so as to occupy absolutely no extra floor space.

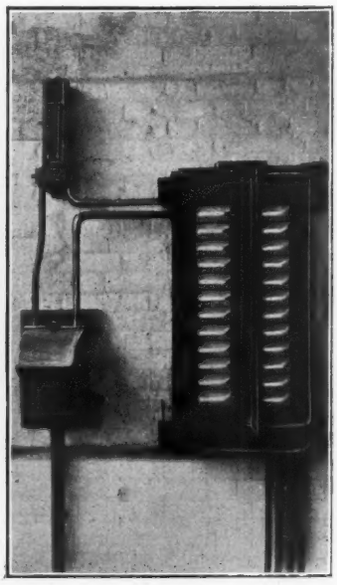
We understand that the machines equipped with Mr. Mascord's system have given very satisfactory results in every way. The high gear ratio at starting up enables the smallest movements to be effected with ease, and the starting current is, of course, very small—the motor can be started in gear, without taking much more than its light-load current. At full speed there is no loss in the gearing at all. Ball bearings are used throughout, and have proved very efficient. The variable-speed motor with commutating poles is one of Mr. Chitty's design, specially arranged for use in conjunction with this gear, and made by Messrs. Thos. Parker, Ltd.

Passing on with the newspaper, the final stage is the transport of the bales of copies to the distributing room. This is accomplished by means of special bale elevators, which are constantly running, and are so designed that the bales placed on a supporting grid are picked up in succession by a series of corresponding grids, which pass between the slats of the fixed grids. A counting finger is actuated by each bale as it rises to the street level, but remains inactive when the carriers are empty; its indications are electrically transmitted to the publisher's office and recorded there. There are two of these lifts, operated by 2-H.P. motors. Each bale consists of five quires of 26 copies, and the lifts can each deal with 150,000 copies per hour. In one night recently as many as 1,800,000 copies of *Lloyd's Weekly News* of 28 pages were turned out between 8 p.m. and 5 a.m. A Pickering electric lift operated by a 15-H.P. motor is provided for passenger service.

As the sub-basement is 44 ft. below street level, sewage and seepage have to be raised 18 ft. to the level of the sewers. This is accomplished by means of a Shone pneumatic ejector, supplied with compressed air by an automatic plant driven by a 5-H.P. motor. This plant is in duplicate. A complete system of 300 Pearson fire alarms is installed. In addition to the public high-pressure water supply, there is a tank on the top of the building. An Ellington plant provides for the raising of the pressure of this town supply to 90 lb. by an injector fed from the hydraulic power mains, which supply the lifts



"COUNTRY LIFE"—FLAT-BED MACHINE DRIVEN BY SINGLE MOTOR.

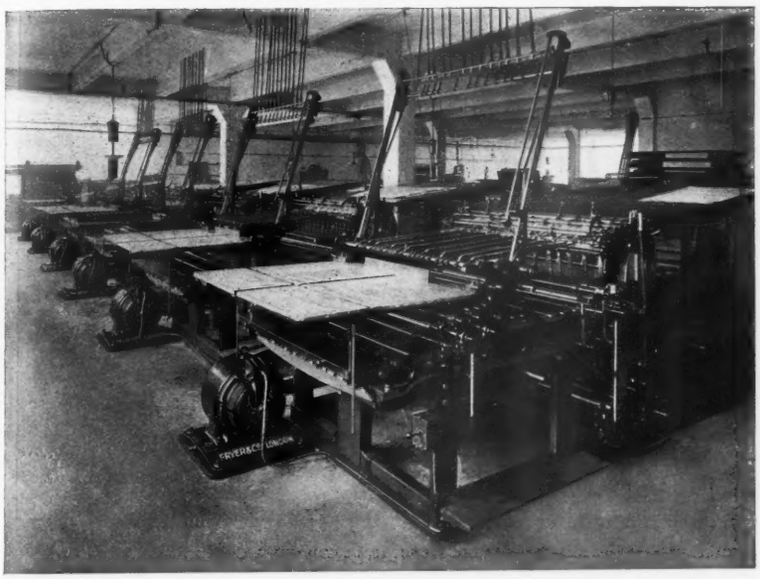


DISTRIBUTION BOX, SWITCH AND METER.

used to raise the paper rolls to the machines. The latter, by the way, are provided with revolving turrets designed by Mr. Mascord, which enable eight full rolls to be placed in position ready to be substituted for the roll spindles in use directly these are empty, the operation being effected in a couple of minutes.

Three complete sets of fan operated ventilating and heating equipments on the plenum system by the Sturtevant Co., each worked by a 7-H.P. motor, are installed.

Systems of rapid communication are carried to a high degree of perfection at Messrs. Lloyd's. There are 70 house telephones connected to a private exchange, and 58 connected to 10 lines of the National Telephone Co.'s system, besides many private lines direct from point to point. There is also a set of signals for transmitting orders to the machine rooms, such as "Stop Press" and "Run on," which are exhibited on translucent panels by electric lamps, a bell sounding at the same time, and working in connection with loud-speaking ship's type telephones for these noisy departments solely.



Flat-bed Machines in "Country Life" Offices.

The Synchronome electric clocks are installed throughout the building, and are synchronised from Greenwich every hour.

While we do not claim to have given in this brief article anything like an exhaustive account of this great establishment, we trust we have shown the remarkably thorough and complete manner in which the many advantages of electricity have been availed of in its organisation. Mr. Mascord, we believe, aided by the sound and sympathic backing of his principals, has been responsible for the redesigning and rebuilding of the establishment, together with the conception and laying out of the new plant of Hoe printing presses, and the replacement of the old steam plant by electrical methods. To him we are indebted for facilities to prepare the article and illustrations; and to both Mr. Mascord and his electrical assistant, Mr. T. W. Blake, for their courtesy and patience in explaining to us the details of the apparatus.

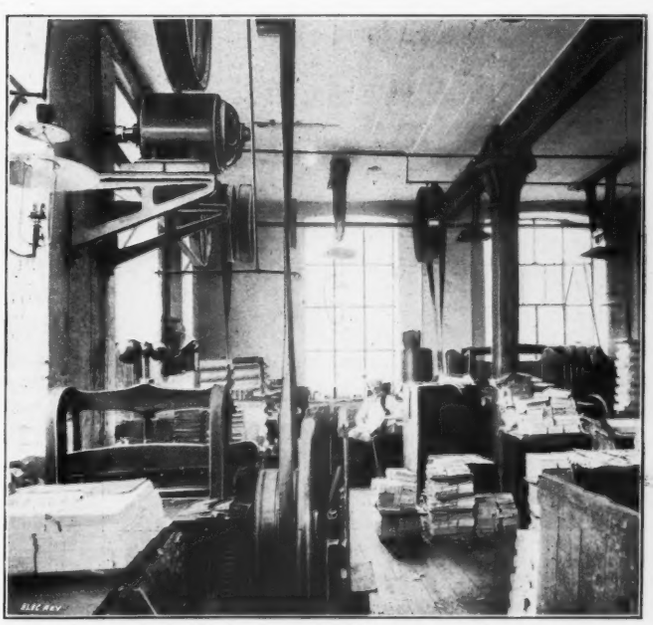
ELECTRICITY IN THE "COUNTRY LIFE" PRINTING OFFICE.

Messrs. Hudson & Kearns are perhaps best known to the general public as the printers of those two beautiful weeklies, *Country Life* and the *Ladies' Field*. But besides what is known as art printing, they do a large variety of general trade printing. In their old works in Southwark Street electricity was but little used, and that more or less experimentally for the purpose of arriving at the method of driving best suited to their particular conditions. Before moving to their fine new premises in Hatfield Street, independent reports were obtained from two consulting engineers, viz., Mr. Frank Broadbent and Mr. A. D. Stevenson, who subsequently jointly designed and supervised the electrical equipment.

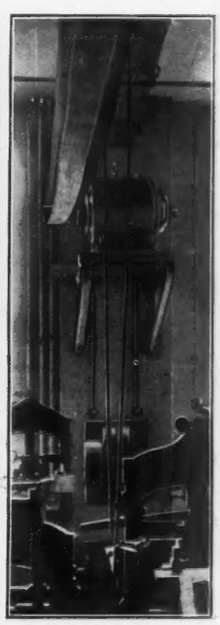
The building is of ferro-concrete construction, each floor being divided into several fireproof compartments. Two independent three-wire supplies at 210/420 volts were brought into two meter rooms situated in separate fireproof divisions, where ironclad main switches and fuses were fixed alongside the city companies' double-tariff meters. From each of these points a pair of heavy mains were run in wrought-iron troughing slung from the ceiling to a central main switchboard. This board was designed from the point of view of safety, as regards both fire and shock, rather than useless ornament.

The board is constructed of white marble slabs on angle-iron framework, and contains main change-over switches, as well as change-over switches for each power and lighting circuit. Thus it is possible to balance up the load on the two supplies as desired.

A main moving-coil ammeter is connected in each supply. The switches are all of the double-pole coupled tandem change-over type, and are entirely enclosed in sheet-steel covers, so that there is no possibility of a shock being obtained inadvertently by anyone passing the board. The illustration, fig. 1, p. 910, shows the switches with the covers removed. The fuses in each circuit are all of the switch-handle pattern, with absolutely shielded contacts. The clip contacts are sunk in the marble, so that an attendant



Motor Drive for Guillotines and Trimming Machines.



Motor with Starting Panel and Time Lag Below.

Electricity in a Bookbinding Works.

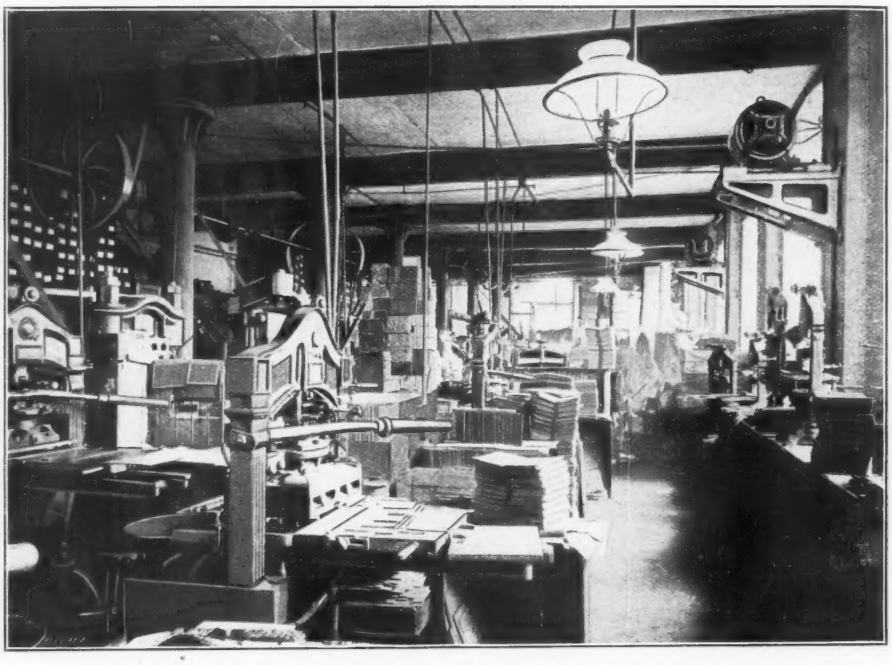
could not inadvertently get a shock, even when the fuse handles were removed.

Each circuit switch feeds a cast-iron distribution box placed in the department served, one being used for each fire-proof division on each floor. The boxes are fitted with switch handle fuses, a pair for each individual motor, and the hinged lids of the boxes are so constructed that it is impossible to open both at the same time so as to expose both poles. One of these boxes is shown in fig. 3, p. 910, with its D.P. isolating switch and Reason meter. The cables leading therefrom to the motors are all enclosed in screwed conduit, some of which are shown in the illustration.

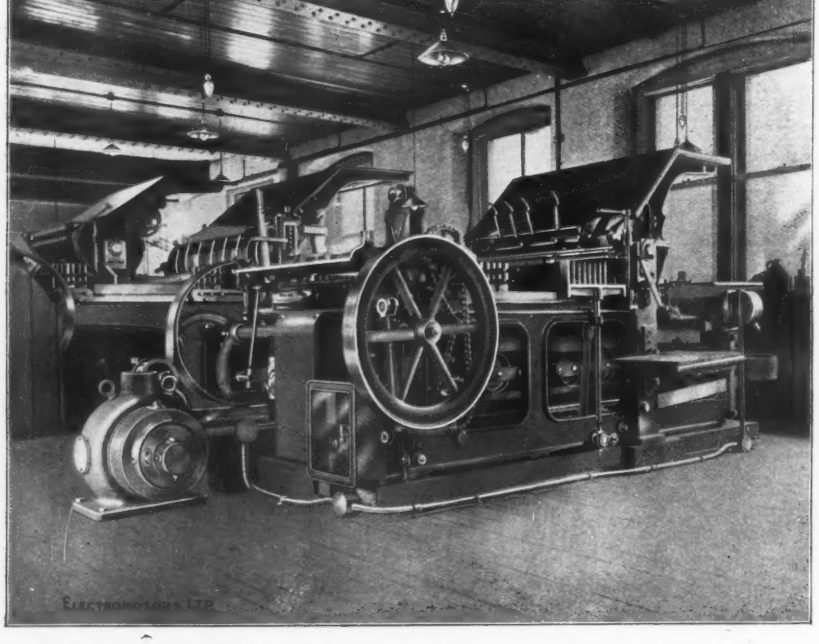
Individual driving is adopted for all the flat-bed machines; the platens, guillotines, and warehouse machinery are grouped on line shafting. Fig. 4 shows a row of Miehle & Cottrell machines, each with its own motor, and fig. 2 shows one machine more in detail. It will be seen that the fast and loose pulley drive is adopted, due principally to the large amount of all-night jobbing work and to the fact that no satisfactory starting switch had been evolved at a reasonable price at the time the installation was erected, which would stand the arduous duty demanded when the direct motor drive is used. The ordinary starter in the hands of the jobbing printer is absolutely useless for the purpose.

Although a complete system of artificial heating was adopted, it was found that on cold mornings, particularly Monday mornings, a little local heating was required to take the chill off the ink. For this purpose Mr. Broadbent devised an iron-clad electric heater, which is fixed under the ink duct, and is almost the full width of the machine. This gives just the gentle heat required for starting up, and is better than the usual row of gas jets.

The contractors for the motor section were Messrs. W. T. Fryer and Co., the motors (about 70 in all) being made by the Lancashire Dynamo and Motor Co., Ltd. It is interesting to observe that the cost of lighting and power is considerably less than the former cost of gas used for lighting and driving, although the volume of work turned out has enormously increased.



ELECTRICITY IN A BOOKBINDING WORKS: ELECTRICALLY-DRIVEN BLOCKING MACHINES.



THE CO-OPERATIVE PRINTING SOCIETY'S WORKS (p. 914), LITHO PRESS ELECTRICALLY DRIVEN BY MEANS OF SHORT FLEXIBLE BELT AND JOCKEY PULLEY.

ELECTRICITY IN A BOOKBINDING WORKS.

AN interesting example of change-over from gas-engine to electrical driving, is afforded by the works of Geo. Simpson & Co., Ltd., London, whose bookbinding establishment had been run by a gas engine of 10 H.P. This power being insufficient, the directors were faced with the alternatives of either getting a new gas engine of larger power, or of having part of their works run electrically, or of discarding the gas drive and running the whole works electrically.

Space had to be considered, and also the need, during the busy season, of there being as little chance as possible of a breakdown, so that in the end it was decided to abandon gas driving and to run the whole works electrically.

The average load over the year was about 9 H.P., with a maximum load of about 15 H.P.; to provide for extensions, six motors aggregating 18 H.P. were installed. The motors, ranging from 5 to 2 H.P., are Newton's D.C. protected type, 200 volts, running at about 1,100 R.P.M., and have in every case been fixed on wall brackets, so as to be out of the way, with the starter panel suitably placed below, the drives being arranged so as to admit of the existing shafting being used with slight alteration, as it was imperative that no cessation of work should take place during the change-over.

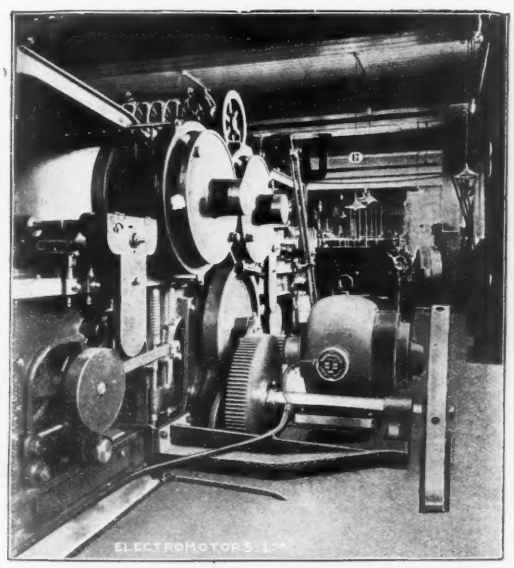
The wiring throughout is in screwed tube, and energy is distributed from two boards on the main floor, each fitted with an ammeter calibrated in H.P., and placed so that it is easily under the control of the office staff.

On the main floor the heaviest drive is a range of three guillotines and a trimming machine, which we illustrate

and which is driven by a 5-H.P. motor supplied through a time lag overload release, while the rest of the shop, which includes a pair of hydraulic pumps, is run by a 3-H.P. motor.

On the second floor two heavy blocking machines, with one or two smaller machines, are run by a 3-H.P. motor also provided with a time lag (by Messrs. Morris and Lister) arranged so that in the event of an overload there would be time to throw out a machine before the release acted, and so avoid stopping other machines unnecessarily. A second 3-H.P. motor drives a third blocking machine, together with some half-dozen sewing and other machines. Since the work was completed, several machines formerly worked by hand, are now belt-driven from the main shaft. On the third floor, which is occupied by stitching machines and a small guillotine, two 2-H.P motors are installed, either of which is capable of driving the whole floor in emergency, and it is on this floor that the steadiness of the drive has had the most effect on the work. Previous to the change, every demand on the gas engine slowed the machines down so that there was no constancy, and we understand that one result of the steady drive, besides the more accurate work, is a diminution of the upkeep costs of the machines.

The Co-operative Printing Society's Works (p. 914), Group of Platens Driven by Motors with Adjustable Jockey Pulleys. Under the Table is a Double-Pole Switch for Stopping the Motor, and a Combined Starter and Regulator.



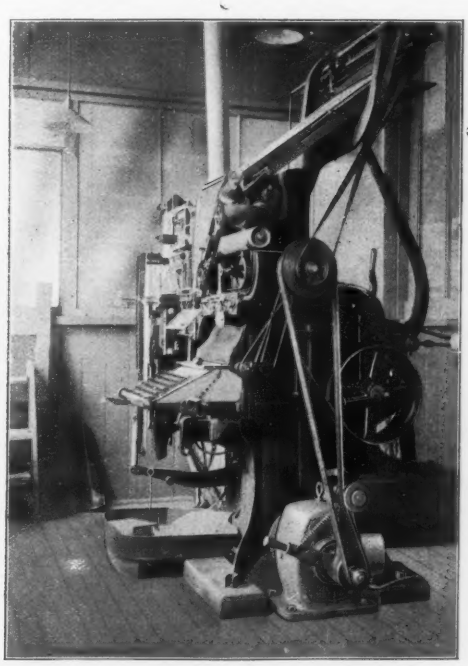
The Co-operative Printing Society's Works (p. 914), Perfecting Machine Driven Through Gearing (Gear Case Removed).

The question of efficiency being fully answered there remains only the question of comparative cost, and as the installation has only been running seven months, it is impossible to give an actual comparison over a year.

The actual cost of the gas engine plant was approximately £160 per annum of 2,700 working hours, while the estimated cost for the motor installation, using 15,000 units per annum, was about £150.

But as the actual consumption for five months, and these the busiest of the year, was 5,759 units, it would seem that the annual consumption will fall considerably below the estimate.

It is worthy of note that throughout the installation British material has been used exclusively. Messrs. Parmiter, Hope & Sugden supplied the switches for the installation, the Electrical Apparatus Co. the starters, and Messrs. J. H. Tucker the main fuseboards, while the instruments are by Messrs. Nalder Bros. & Thompson, and the cables by the Liverpool Electric Cable Co. The work was carried out entirely by Messrs. W. Mackie & Co., to whom we are indebted for the details. We are also indebted to Messrs. G. Simpson & Co., Ltd., for permission to inspect the installation, and to take the necessary photographs.



The Co-operative Printing Society's Works (p. 914), Linotype Machine Driven by Motor Fitted with Jockey Pulley Controlled by Spring.

Plymouth Electric Lighting.—At a meeting of the Electricity Committee on Friday last, the electrical engineer (Mr. Okell) was instructed, on the suggestion of a member, to consider and report on the advisability of hiring out electric motors. The return of the electrical engineer for April showed estimated receipts £2,006, against £1,741 in April, 1909.

ELECTRIC DRIVING AT THE CO-OPERATIVE PRINTING WORKS, MANCHESTER.

When the works of the Co-operative Printing Society, of Manchester, were enlarged two or three years ago, a complete electrical installation was put in, and the whole of the machinery rearranged in accordance with the specifications of Mr. Frank Broadbent, M.I.E.E., the Society's consulting expert, working in conjunction with the architect, Mr. Ernest Woodhouse, F.R.I.B.A. Current is taken from the mains of the Manchester Corporation at 200 volts, the installation being split up into two distinct portions, with the two halves on opposite sides of the three-wire system. Two complete switchboards, which are duplicates of each other, are employed, each controlling one-half of the installation. The switchboard enclosures form extensions of the principal overseer's office, full-sized doors being provided for access to the back, as well as to the front of the boards. Overload-circuit breakers are fitted in the mains on each side of the system. From the main boards, which consist of polished marble panels containing the necessary D.P. circuit switches, fuses, ammeters, &c., circuit cables are led to cast-iron distributing boxes in each department. Each box contains about a dozen pairs of switch handle fuses, and is surmounted by a moving-coil ammeter and plug board, by means of which the current in any motormay be indicated at any time without stopping the motor or interfering with it in any way. Individual driving has been adopted throughout for the printing machines, including the platens, so that no shafting at all is used in these departments. The small warehouse machinery, such as stitchers, sewers, perforators, and the like, are arranged in small groups, but the guillotines are each driven by individual motors. The machines are driven by belt or spur gear, depending upon the conditions.

The lithos., for instance, are driven by a belted motor placed close under the driving pulley, as shown on p. 112. The belt, it will be noticed, passes under a jockey pulley, which is kept in contact with it by spring tension. At the right-hand side of the operator's platform will be seen a D P. switch, which is the only switch he handles. As soon as he closes this, the automatic starting switch seen at the end of the machine slowly starts the machine up to the speed for which the speed regulator is set. The regulator is a very compact piece of apparatus, and is fixed near to the starter. It is provided with a removable handle so that the speed can be set by the minder or overseer, and cannot be altered without his consent.

Another view on p. 113 shows a general view of the machine room, the machines in the foreground being individually driven platens. The drive is by belt and adjustable jockey pulley, the spring tension being adjusted by means of the handle shown on the motor driving No. 7 machine. The switchgear for these small machines is hand operated, and is fixed under the feeder's table. The starter is combined with a field regulator capable of giving a 50 per cent. speed variation. On the column near the figure 6 is fixed a sub-distribution box from which the platens are fed.

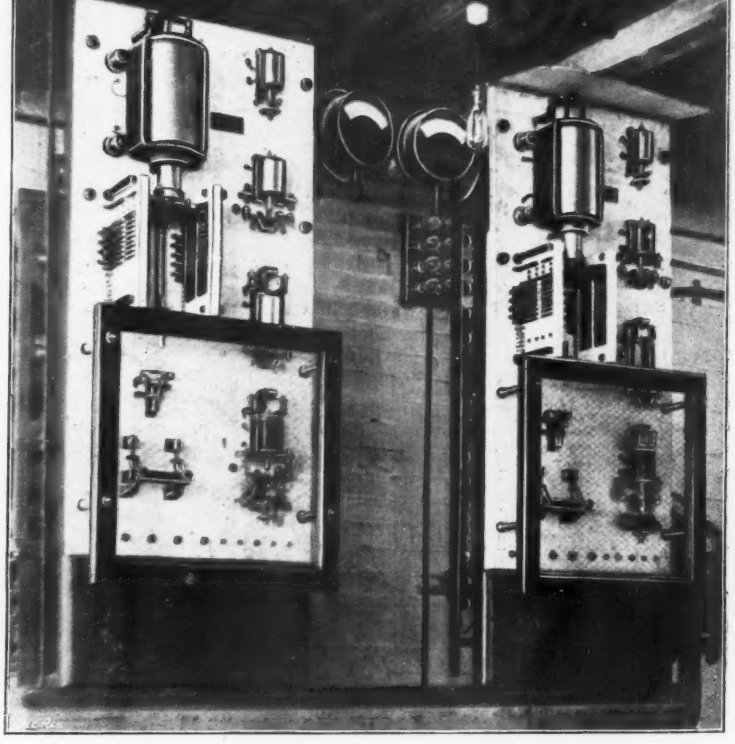
Other views show a Payne perfecting machine driven through gearing, and a Linotype machine driven by a motor fitted with a spring-controlled jockey pulley, this being one of a number of similar drives in these works.

The whole contract includes about 60 motors, and was carried out by Electromotors, Ltd., of Openshaw, under Mr. Broadbent's supervision.

The installation has been running for about three years, and, we understand, has so far cost practically nothing for repairs, which speaks well for the excellence of the motors.

KOHLER INSTALLATION AT THE "LEICESTER MAIL."

The printing plant at the *Leicester Mail* consists of two Hoe two-roll presses, which are operated by means of two 20-H.P. Crompton motors controlled on the Kohler system. These are the first sets of Kohler single-motor control to be installed in this country, although a large number are in use in the United States on similar presses and on magazine presses.



Kohler's Single Motor Controllers at Leicester.

The presses are controlled from various points by means of push-button stations, the apparatus being illustrated herewith. By means of these stations the press is entirely under the control of the operator from every point, and much valuable time is saved thereby at the critical moments when the publisher is calling for copies. The signal results obtained during the recent Election and subsequent racing season clearly demonstrated the utility of the system in Leicester, when the *Mail* was on sale in the streets within a very few minutes from the receipt of results at the office. A similar installation to this is in operation at the Japan-British Exhibition.

The London *Daily Graphic* is installing a new Hoe rotary press in three sections. Each section has its complete Kohler two-motor outfit, and the equipment is so arranged that all three can be run as separate units, or any two, or all three in parallel. We understand that this is the first instance in this country where this has been done.

The *Leicester Mail* is unique in being the first newspaper to be produced by power furnished from the tramway circuit, and Mr. T. Robert Smith, the Corporation tramways engineer, is to be congratulated on having seen the possibilities of getting a profitable power load in this direction.

The Kohler system is now installed in most of the principal newspaper offices in the United States, and is operating presses at the London *Morning Post*, *Times*, *Mirror*, *Daily Mail*, &c., and also in several Colonial offices and on the Continent of Europe.

Electrical Apparatus for Printing Works.

The Westinghouse Cooper-Hewitt Co., Ltd.

As a means of lighting newspaper and printing offices, the Cooper-Hewitt mercury vapour lamp has met with considerable success, owing not only to its high efficiency (the current consumption being about ·38 watt per candle-power), but on account of the nature of the light emitted, which is soft and restful to the eyes; owing to its diffusion, and the practical absence of shadows it is especially comfortable and even beneficial to work under.

The lamps can be run in parallel or in series according to the voltage. Each consists of a glass tube about 1 in. in diameter, of varying length according to the type, having a mercury reservoir at one end, forming the negative electrode, and a special iron electrode for the positive at the other end; the electrodes are connected by platinum wires sealed through the glass to flexible wire connectors at either end. The tube is exhausted of all air, and contains only metallic mercury which is vaporised by the passage of the current, and becomes highly incandescent at a comparatively low temperature, emitting a highly-penetrative light of great brilliancy, but with an almost entire absence of red rays.

The form of the lamp (the light-giving surface being of very much greater area than in the case of any other lamp) and the colour effect of the light accounts for the diffused and restful illumination which is obtained. The absence of red rays produces a certain distortion of colour values; this, however, is not any disadvantage in ordinary printing and newspaper work. On the other hand, the type on the compositor's desks stands out with particular prominence, the reflections from new type being very much subdued, and actual print showing up very clearly under the light. The lamps are, therefore, well suited for use in the various departments and offices, particularly in composing and machine rooms.

Two distinct sizes of lamps are made, the 500-c.p. lamp, type "H" tube, having a luminous length of 18 in. to 22 in., suitable for burning in parallel on 50 to 60 volts, or in series on higher voltages, and the 1,000-c.p. lamp, type "K" tube, having a luminous length of 42 in. to 44 in., suitable for burning in parallel on 100 to 120 volts, or in series on higher voltages.

To start the lamps, the tubes must be tilted so that the stream of mercury makes contact with the positive electrode. A small arc is then formed which vaporises a certain quantity of mercury; this being accomplished, the tubes return to their normal position, which is generally at a slight inclination from the horizontal, but may be anywhere between this and a vertical position. Tilting of the tubes is generally accomplished by hand by means of a light chain, though lamps of either candle-power are made to tilt automatically on closing the switch. The lamps are also made with self-contained or separate resistances to suit all requirements.

Owing to the special nature of the light and its high actinic value the lamps are largely used and found of great service for all classes of photographic work, including copying, enlarging and photo engraving, the definition obtained being in many ways superior to that possible with other illuminants.

We illustrate the composing room of the *Newcastle Chronicle*; this view was taken at night with the normal illumination of the room by mercury vapour lamps. In this department there are eight type "H" automatic-tilting lamps and four type "K" hand-tilting lamps, which have now been in service for a very considerable period.

Westinghouse Cooper-Hewitt Lamps in the Composing Room of the "Newcastle Chronicle."

Amongst other important installations we may mention that of the *Manchester Guardian*, where 16 type "H" mercury vapour lamps are in service, the first of these being installed in 1908. The installation at first met with opposition on the part of the compositors owing to the colour of the light. They were, however, persuaded to give the lamps a trial, with the result that after they had been in service for a short period they were so much in favour of the illumination on account of the increased comfort and ease in working experienced, and the decreased feeling of eye-strain and fatigue, that they were most anxious that they should be retained. Since then further lamps have been installed.

The *Daily News*, Manchester, have also adopted automatic-tilting lamps, their burning hours being about 4 000 per annum. The installation is reported as giving every satisfaction.

In London, the *Daily Chronicle* have a large installation in their composing room, with a total illumination of about 8,000 c.p.; consumption, 2,800 watts. These lamps replaced 65 16-c.p. carbon-filament lamps, with a total illumination of 1,040 c.p., having a consumption of 3,900 watts. The experience in the matter of this installation is evidently also satisfactory, as in common with many others the number of lamps has been increased since first supplied.

Amongst other newspaper and printing offices which have adopted this means of illumination may be mentioned the *Glasgow Herald*, *News of the World*, *Dundee Advertiser*, Richard Clay & Sons, Bungay; Odhams, Ltd., and Southwood, Smith & Co., Ltd.

Adams Manufacturing Co., Ltd.

Amongst the many specialised types of motor control devised by this well-known company, possibly none has received such attention or been further developed than this firm's systems of printing press control.

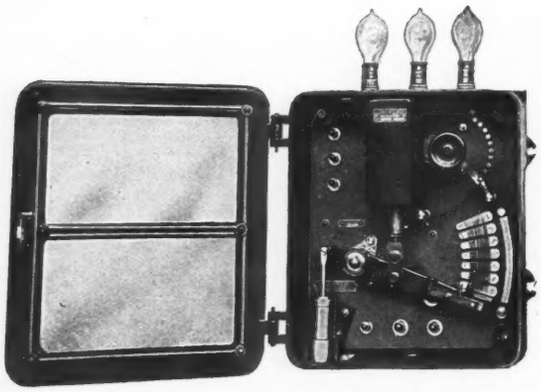


FIG. 1.—SELF-ACTING MOTOR-STARTING RHEOSTAT, WITH INTERLOCKED FIELD REGULATOR, IN CAST-IRON LOCK-UP CASE.

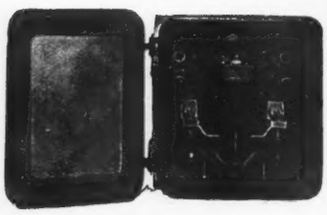


FIG. 2.—SOLENOID CONTROLLED MAIN SWITCH, IN CAST-IRON LOCK-UP CASE.

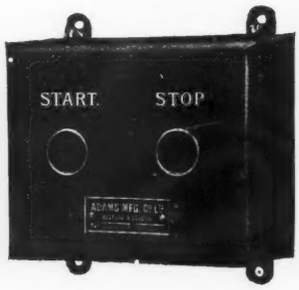


FIG. 3.—IRONCLAD PUSH-BUTTON CONTROL BOX.

FIG. 4.—IRONCLAD "INCHING" MASTER SWITCH.

FIG. 5.—IRONCLAD MASTER SWITCH, WITH PROTECTION FOR SHUNT FIELD.

A simple and reliable switch system is desirable for the printer, whose attention is necessarily centred on his machine, and possibly the arrangement best fulfilling these ideas is a "push-button" system.

The Adams Co. supply a push-button starting gear for small machines, of which the component parts are illustrated above. Fig. 1 shows a solenoid controlled starting switch fitted with an adjustable oil dashpot, and with a small field regulator on the same panel; fig. 2 is a solenoid circuit-breaker or main switch; these two devices are controlled by master devices of suitable type, and can be installed in any convenient position.

The master devices are fixed on the press, and may be in the form of an iron-clad push-button control box, as shown in fig. 3, or a small two-way master switch of either of the types shown in figs. 4 and 5, the latter being provided with an automatic release devise for the purpose of opening the main circuit in case of a rupture of he motor shunt field circuit.

The operation of either form of master switch opens and closes the circuit through the solenoid main switch or circuit-breaker (which is fitted with carbon break and magnetic blow-out), and consequently "inching," with its requirements of repeated starting and stopping of the motor before it has reached its normal speed, can be carried out without any ill-effect to the starter itself.

Apart from this automatic control system, the Adams Co. make a hand-operated starter which is intended to secure many of the advantages of the former system at less cost. Briefly, such a panel contains, in addition to the starting switch, an interlocked clapper type circuit-breaker arranged so that, on the slightest backward movement of the starter handle, the circuit-breaker instantly opens; consequently, no arc occurs on the starter steps, because they are dead. With this starter, therefore, "inching" may be carried out without damaging the contacts; further, the interlock is arranged so that it is impossible to close the motor circuit except with all the starting resistance in circuit, so that the motor is properly protected.

In fig. 6 we illustrate an Igranic rotary press controller which demands the use of only one compound-wound motor for driving the press. The crawling speed may be 5 per cent. of the maximum or even less, and this is obtained by the potentiometer method of armature control which ensures sufficient torque at starting and at low speeds.

Such an arrangement saves the expense of an independent motor geared for low speed, or an extra motor-generator. The change from preparing to minimum printing speed is effected by resistance in series with the armature and for controlling this resistance a large number of steps are provided to ensure smooth acceleration. The higher printing speeds are then obtained by first diverting the series field current and afterwards introducing resistance into the shunt field circuit. While the speed regulation is effected by the large rotary handle, starting, stopping, &c., can be accomplished by the small switch in the right-hand upper corner of the panel, and any number of small switches can be fixed in convenient positions round the press. A complete push botton control can be installed with the above apparatus, the panel then being made self-acting.

Each push button station consists of six buttons marked respectively "inch," "start," "accelerate," "retard," "stop," and "lock."

The latter button when operated puts all the others (except those for stopping) out of action, thus safeguarding anyone working on the press when at rest, and also preventing any alteration of speed when printing has commenced.

While this "lock" button can be operated at any station, it can only be released at a master station under the foreman's control, which contains an extra button marked "free," for this purpose. It will be noticed that the "stop" buttons are always operative.

The Adams Co. make numerous other switch controls which have been adapted for special conditions, many of which have appeared from time to time in our pages.

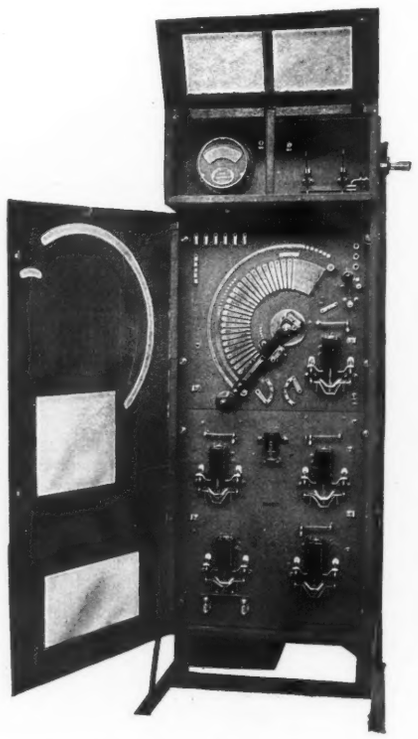


FIG. 6.—IGRANIC ROTARY PRESS CONTROLLER. When the cover is closed, the operating handles project through slots. The upper case contains an ammeter and a double-pole switch.

The Adnil Electric Co., Ltd. (Marples & Leach).

This firm have specialised in the application of electricity to printing machinery for many years, and their productions are well known in the principal printing offices in the United Kingdom.

The well-known Lundell type motor has been supplied during the past 10 years for the purpose of driving small flat-bed machines,

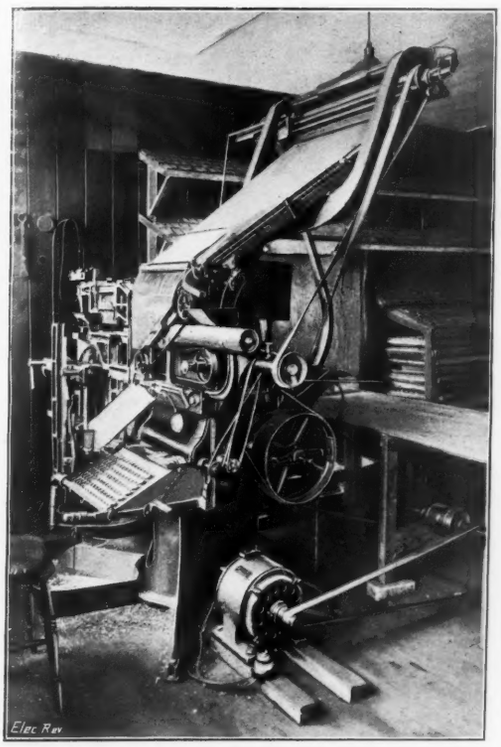


Fig. 1.—Adnil Single-Phase Motor Drive in Printing Works.

foundry machinery and bookbinding machines with the greatest success, and being capable of sustaining very considerable overloads and any amount of rough usage, is eminently suitable for the purpose. Lundell motors are provided both of the open protected and totally enclosed types.

For driving rotary printing presses, the Adnil Electric Co. have developed a complete line of interpole compound-wound motors, having a very wide range of speed regulation; for instance, fig. 2 illustrates a 25-h.p. motor direct-coupled to a two-roll rotary printing press, capable of running at any speed between 400 and 1,200 r.p.m., the whole of this range being accomplished by the shunt method of control. The controller will be seen mounted upon the folder at the delivering end of the press in a handy position for the machine minder. It is provided with seven armature regulating position and 15 field regulating positions, so that the speed of the motor can be varied from zero to the maximum, and back again to zero when nearing the end of a rail or for slowing down a machine.

The controllers are constructed of incombustible material throughout and provided with powerful magnetic blow-out with insulated baffle plates between the fingers, and both the fingers; and the drum segments are separately mounted and are easily and cheaply renewable.

In connection with this controller the Adnil Co. provide a special no-volt and overload release circuit-breaker, with magnetic blow-out made of incombustible material throughout. This circuit-breaker has a special interlocking device which prevents the circuit-breaker being closed until the controller has been returned to the zero position, thus preventing any accident to the electrical equipment due to carelessness on the part of the operator.

In connection with this circuit-breaker, push buttons are provided in convenient positions around the press, so that the current can be immediately cut off should it be desired to stop the press in case of emergency.

An equipment of this type will provide all the slow motion speeds required for the "making ready" process, that is to say—the cylinders of the press can be moved round an inch or two at a time for the purpose of attaching the plates, &c., and for running at speeds of 6 to 8 r.p.m. for the purpose of threading the web through the machine.

It will be appreciated that the wide speed regulation provided by the shunt method is very valuable in a printing office, where these large rotary presses may be required to run at something below the maximum speeds for long periods of time together; as no wasteful resistance is employed, the high efficiency of a drive of this nature will be apparent.

It is becoming a common practice in certain newspaper offices to install rotary printing presses which can be either used as a single machine, to produce a weekly paper of 16 pages, or as two machines to produce evening papers of 8 pages.

The electrical equipment for such presses has to be divided into two halves, and so arranged that the two halves can be run separately or combined as one unit.

In order to meet the requirements of such cases, the Adnil Co. have developed a special form of control gear, which is illustrated in fig. 5. It will be noticed that the two controllers and the automatic circuit breakers are mounted upon one switch panel, the controllers being in a horizontal position, and the drum shafts being extended. When it is desired to run the two motors as one unit, the controllers are brought to the zero position, and a parelleling switch closed in the centre; this at the same time automatically locks the two spindles together, so that a combined movement takes place; the paralleling switch is used for paralleling the series field, so that the load is equally divided between the two motors. It is impossible to close either circuit-breaker until both controllers have been brought back to the zero position, and it is further impossible to close the paralleling switch until the controllers are in the "off" position.

This arrangement has been found entirely satisfactory, and is in use in many of the provincial newspaper offices.

In some cases, especially in the case of large rotary presses, it is desired to operate the controller from push-button stations placed upon the press, and, in order to meet this requirement, a special form of remote control has been developed, which consists of two solenoids operating a ratchet device, and so designed that by pushing a button upon the press the controller to which the device is attached is rotated step by step from zero to the maximum speed. On the fingers being removed from the button the device will stop working, and the press will run at the speed at which it has arrived. If it is desired to stop the press, a stop-button is provided which auto-

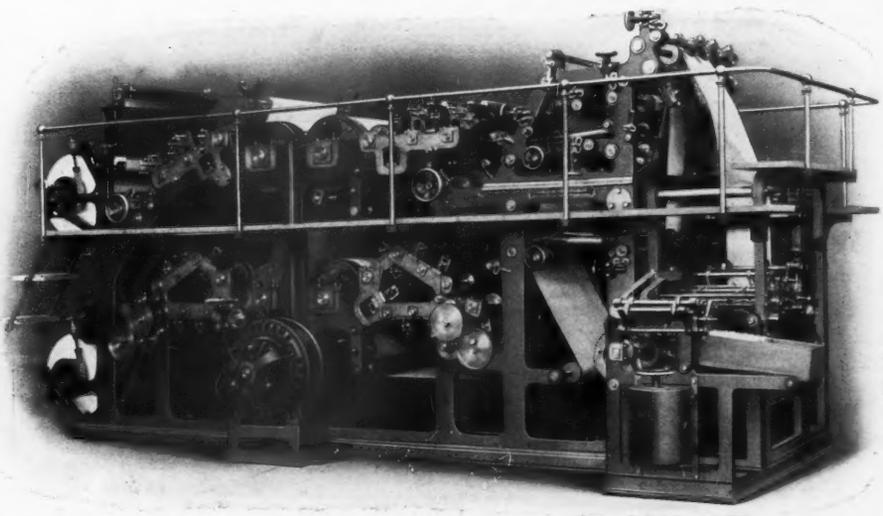


Fig. 2.—Rotary Press with 25 h.p. Motor Drive.

matically opens the circuit-breaker and causes the control apparatu to return to the zero position automatically.

To reduce the speed of the press, a reducing speed-button is provided, by which the controller can be gradually moved step by step towards the zero position.

The action of this particular form of control apparatus lies in

the fact that it is impossible to accelerate the press at too rapid a rate, and further, the action being positive, it is impossible for the controller to rest except exactly on the contacts.

This has overcome the difficulty which has been experienced hitherto in operating controllers from a distance; many attempts have been made to apply a small pilot or turning motor to operate controllers in connection with printing press work, but have failed, mainly due to the fact that, on occasion, the controller was moved to a position between two contacts, which set up destructive arcing and rendered the equipment out of service.

The Adnil Co. supply a polyphase induction motor with a belt-driven countershaft, specially designed for use in connection with Linotype or similar machines, running at slow speeds.

The countershaft is mounted in an eccentric bearing bracket which is provided with springs to keep the belt in tension. This form of drive is found most satisfactory on account of the quiet running. In order to keep the belt in tension from the countershaft to the machine pulley, the whole motor and gear is mounted upon a swing base, with spring adjustment so that the tension may be kept exactly right.

Fig. 3 shows a Lundell type motor direct coupled to a hoist or lift gear, together with an Adnil lift controller for rope operation. This controller is designed in such a way that by pulling the control rope in one direction the motor is started up, and by pulling the control rope the other way, the motor is started up in the reverse direction, the resistance being cut out at a predetermined speed, which is controlled by the air vane shown in the illustration, and which limits the speed to the normal required by the motor. These controllers are being used very extensively in many of the important printing offices in connection with paper hoists, passenger lifts, &c.

The Adnil Co. supply printing press equipments for single-phase, two-phase, or three-phase circuits, for both flat-bed and rotary machines, having developed special control apparatus for this purpose.

In connection with single-phase circuits, a single-phase induction repulsion motor can be supplied, the peculiar feature of this machine being that it will develop from 1½ to twice its normal torque at starting, and can therefore be direct-coupled by either belt or spur gear to the machine which it has to drive.

When the motor has got up to speed, an automatic device lifts the brushes from the commutator, and at the same time short-circuits the segments so that the machine runs as an induction motor normally. Such motors can either be started at a distance or by a switch placed on the machine. The brush lifting device is entirely automatic in operation, and the

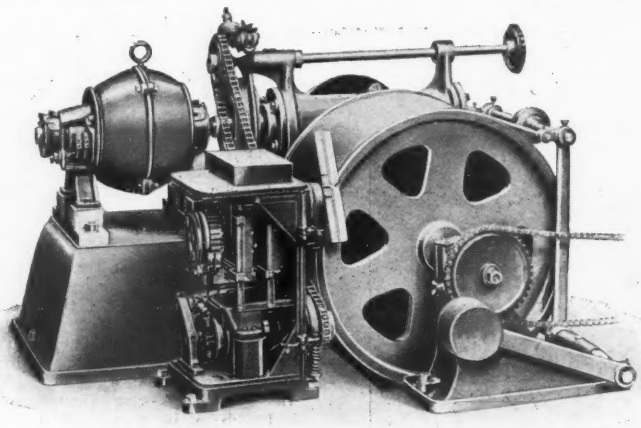


Fig. 3.—Adnil Controller and Motor-Driven Hoist.

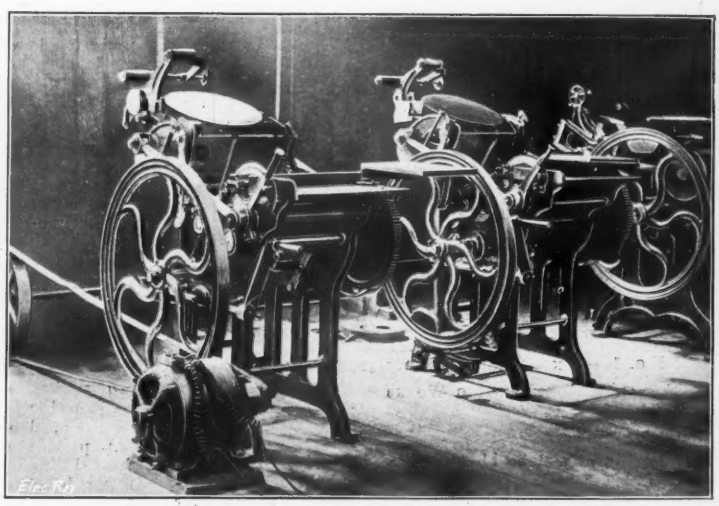


Fig. 4.—Platens Driven by Single-Phase Motor.

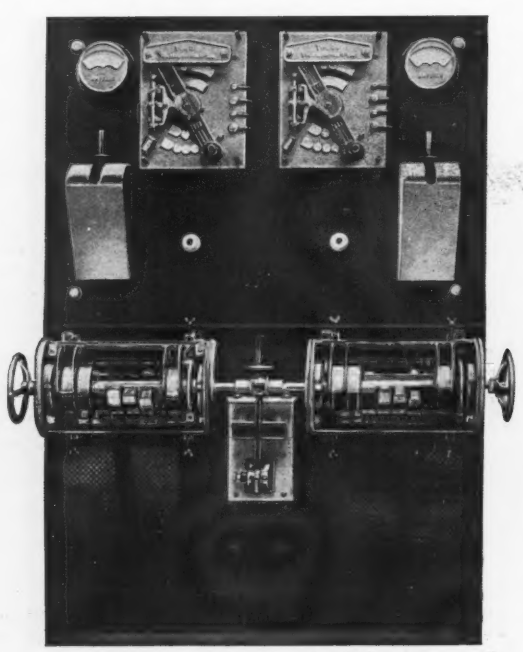
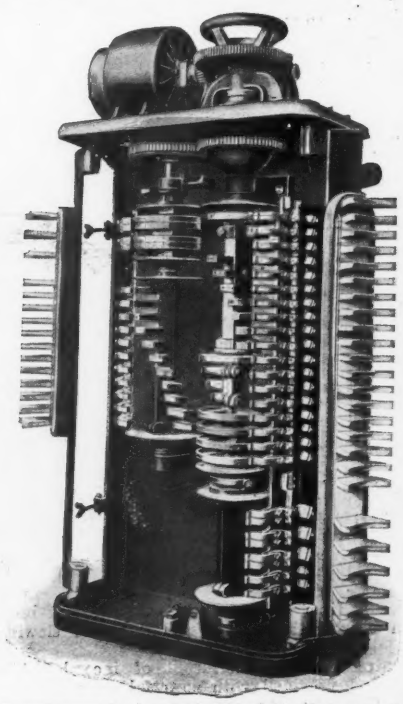


Fig. 5.—Adnil Duplicate Control Panel for Rotary Press.



E.O.A.C. Electrically-operated Press Controller (p. 919).

simplicity of starting these motors has been greatly appreciated by printers where these machines have been installed. This firm has recently supplied a number of single-phase self-starting alternating-current motors in the West of England, for driving printing machinery, and our remaining illustrations show some of the applications of these machines.

Electric and Ordnance Accessories Co., Ltd.

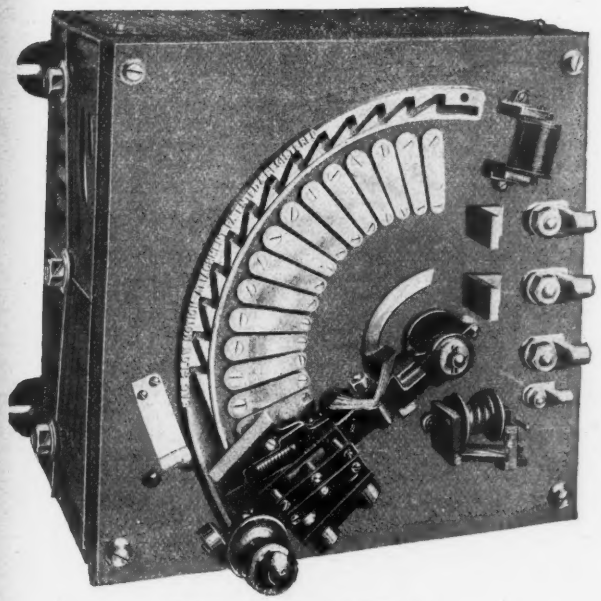
Amongst the various apparatus in which this company specialises will be found a number of types of controllers adapted for use in the printing trade.

These controllers are of the well-known barrel type, fitted with hard-drawn copper fingers and contacts, easily and cheaply renewable; powerful magnetic blow-outs are provided on every step, the blow-out coil being connected in series in the main circuit.

The parts are mounted on a cast-iron carcass and sheathed with sheet iron. No wood or other combustible material is used in these controllers, which are designed for use with either alternating or direct-current motors. We illustrate on p. 918 a special controller of the N.B.Y. type, which is electrically operated and generally used in conjunction with a push-button system on large printing presses, this arrangement providing for starting and stopping from any desired position on the press. These controllers are in use in some of the largest newspaper offices in the kingdom.

Electrical Apparatus Co., Ltd.

A type of motor-starter possessing several advantages for use in connection with motors driving printing machinery is the "heavy duty slow-motion starter" made by this company. This is fitted with the step-by-step device patented by the company, consisting of a saw-tooth path traversed by a pawl attached to the switch-arm; it is impossible to move the latter so as to cut out resistance quickly, as any attempt to do this results in the pawl at once



E.A.C. Slow-Motion Starter.

catching on the teeth. Besides providing for a slow and regular start, the device also ensures that the brush shall come to rest at each step in the proper position on the contact plate. In the reverse direction the pawl does not offer any resistance to quick movement. In the full-on position, the arm is held by a no-volt magnet, and the resistance is short-circuited by a switch; an overload cut-off is also provided.

Electric Letter Vans.—For two years past the postal authorities of Berlin have been experimenting with electromobiles for use on postal work, and the outcome of their labour is that orders have lately been placed for a further 20 working and supplementary vehicles. The delivery of these vehicles was to be effected, says the *Berliner Tagesblatt*, in the course of May, and they will serve as substitutes for the 14 lines of letter wagons which now gather the letters from the various outlying localities and take them to the Central office in Spandau Street, receiving there the made-up letter bags and packets for distribution to the delivery offices. The electromobiles will be accompanied by postal assistants, who will sort the letters inside the vehicles during transit, so as to save time at the local offices. They will, however, not go on the first journey, nor the eighth and later journeys, as no deliveries are made on these occasions.

CONTRACTS OPEN.

(*Concluded from page* 906.)

Cape Colony.—Cradock.—June 17th. Tenders are required by the Commissioners of the Municipality for the installation of electric light plant, for street lighting. Tenderers to supply specifications and estimates as to cost. Tenders to Town Clerk.

Devonport.—June 15th. D.C. meters, paper-insulated cables, rubber-covered wires, and cut-outs, and lubricating oils, for a year, for the Corporation. See "Official Notices" to-day.

Germany.—June 14th. The Finance Deputation of Hamburg is inviting tenders for the supply and erection of four electrically-operated cranes.

Ilford.—June 14th. 1,600 yds. of conduit for the U.D.C. electricity department. Particulars from Mr. A. H. Shaw, electrical engineer, at the Works.

Ireland.—June 6th. Electric lighting of the Stewart Institution, Chapelizod. Specifications, &c., from Mr. T. Tomlinson, M.I.E.E., 16, Beresford Place, Dublin (deposit one guinea, returnable as usual).

Italy.—June 8th. 200 junction boxes and 100 plugs for State Railways. June 14th.—19,600 glass shades for electric lights in railway carriages for the Italian State Railways Administration, 16, Via Ludovisi, Rome. Only firms on the special Administration list can tender.

Kingston-upon-Hull.—June 20th. Supplying and laying mains, for the Hull Corporation Electricity Committee. See "Official Notices" to-day.

London.—Stepney.—The B.C. will shortly be advertising for tenders for coal for the electricity works.

Manchester.—June 7th. Special track work for the tramway permanent way, for the T.C. J. M. M'Elroy, general manager of the tramways, 55, Piccadilly (returnable deposit of £2 2s.).

Penrhiwceiber (Glam.).—June 8th. Electrical fittings for a year, for the Penrikyber Navigation Colliery Co., Ltd. (form No. 4, from the Secretary).

South Shields.—June 13th. Stores for the Corporation Tramways Department. See "Official Notices" May 27th.

Stalybridge.—June 11th. Engine fuel and stores for a year, for the Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board. Robert Blackmore, Engineer-in-Chief.

Swansea.—June 27th. Twelve months' supply and delivery of motors and starting switches for the Corporation. See "Official Notices" to-day.

Turkey.—June 15th. The Turkish Ministry of Public Works in Constantinople is inviting tenders for the concession for the construction and working of a further section of electric tramways in the town of Salonika.

October 28th.—H.M. Consul at Constantinople (Mr. A. T. Waugh) reports that tenders are invited by the Turkish Ministry of Commerce and Public Works for a concession for the construction and working of electric tramways in the city of Constantinople and its suburbs. A deposit of £T15,000 (£13,500) will be required with each tender, and the tenderer must also supply a certificate of his financial and technical ability to perform the work. Tenders, marked "Ministère Impérial Ottoman des Travaux Publics, Adjudication d'un reseau de tramways urbains et suburbains à Constantinople et dans sa banlieue," will be received at the Ministry up to October 28th/November 10th, 1910. *Local representation is essential in the case of Turkish Government contracts.* A list of British commission agents established in Constantinople may be obtained, and a copy of the specification (in French) relating to the electric tramway contract at Constantinople, seen, by British firms at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.—*Board of Trade Journal.*

West Bromwich.—June 20th. Paper-insulated, lead-covered, feeder and pilot cables, for the Corporation Electricity Department. See "Official Notices" to-day.

West Ham.—June 20th. Electric light installation at three schools, for the Education Committee. See "Official Notices" May 27th.

CLOSED.

Bury.—The tender of Mr. T. Cornall, of Bury, for installing the electric light in the Municipal Secondary School, has been accepted.

Derby.—The T.C. has accepted the following tenders :—

Chloride Electrical Storage Co., Ltd.—Replating lighting battery, £100 and six annual payments of £93, and maintenance of battery for 12 years, £70 per annum.
Electric Construction Co., Ltd.—Switchboard extension, £309, and motor-generator, £683.
W. Rickard.—Bitumen cable, £1,721.

The order for replating the lighting battery, consisting of 240 cells, has been placed with the Chloride Electrical Storage Co., Ltd.

Dublin.—The Board of Works has given Messrs. R. Waygood, through their Dublin agents, Messrs. W. Coates & Sons, an order for one of their latest pattern push-button automatic electric passenger lifts for the Viceregal Lodge, the residence of the Lord-Lieutenant.

Eccles.—The Corporation has accepted the following tenders :—

British Insulated and Helsby Cables, Ltd.—Cable to be laid from the Electricity Works to Monton Green, for £460.
N. Brookes & Sons, Patricroft.—Foundations for the new steam dynamo.

Erith.—The result of the invitation for tenders for the execution of the work under the U.D.C. Assisted Wiring Scheme for three years, *i.e.*, till March 31st, 1913, as advertised in our pages on April 15th, 1910, was the acceptance of the tender of the Woodville Electric Co., Belvedere.

Grimsby.—The Corporation has accepted the following tenders in connection with the street lighting scheme :—W. Lucy and Co., 300 lamp-posts, £326, and incandescent lamp fittings, £248; J. H. Tucker & Co., house fuse boxes, £37; Phœnix Dynamo Manufacturing Co., balancer, £38; Chamberlain & Hookham and Ferranti, Ltd., two years' supply of meters, total £515. A sample meter has been ordered from the British Thomson-Houston Co.

Heston and Isleworth.—The following tenders have been accepted by the Council for its electric power station extensions :—

W. Lacey, Hounslow.—Buildings, £777.
Browett, Lindley & Co.—250-kw. generating set with Westinghouse Dynamo and British Thomson-Houston switch panel, £1,504.
Babcock & Wilcox.—Steam piping and G. and J. Weir pump, £210.
Körting Bros.—Condensing plant, £300.
Selson Engineering Co.—Machine tools, £102.

Kingston-on-Thames.—The T.C. has accepted the tender of Messrs. W. T. Henley's Telegraph Works for half a mile of 5-ampere cable, at £44 10s., and half a mile of 35-ampere cable, at £87 10s.; and that of Messrs Siemens Bros. & Co. for half a mile of 12-ampere cable, at £58, and half a mile of 22-ampere cable, at £71.

Lambton Collieries.—Messrs. Leech, Goodall & Co., of Pepper Road, Hunslet, Leeds, which firm is an amalgamation of Messrs. Graham, Morton & Co., of Leeds, and Messrs. R. H. Longbotham & Co., Ltd., of Wakefield, have secured the large contract for the Lambton Collieries, Ltd., for the pit-head gear, heapstead, picking belts, bunkers, conveyors, &c., in connection with the extensions at their North Biddick Colliery.

London.—Hammersmith.—The B.C. Electricity Committee received the following tenders for cables :—

		Made at
Standard Cable Co.	£625	Germany.
Union Cable Co.	658	Germany.
Western Electric Co.	(recommended) 660	Woolwich.
Aubert Grenier & Co.	672	Foreign.
Callender's Cable & Construction Co.	700	Erith.
Siemens Bros. & Co.	700	Woolwich.
Johnson & Phillips	700	Charlton.
British Insulated and Helsby Cables	705	Prescot.
W. T. Henley's Telegraph Works	710	London.
W. T. Glover & Co.	715	Salford.
General Electric Co.	735	—
Craigpark Electric Cable Co.	949	Glasgow.

The lowest tender for English-made cable is that of the Western Electric Co., and it is recommended for acceptance.

Messrs. Rushleigh Phipps & Co. have obtained the contract for the electrical work at Messrs. Swears & Wells's premises in Regent Street, which are about to be rebuilt. The new building will be equipped with electric lifts, electric heating, and electric irons, besides electric lighting and automatic intercommunication telephones, and will, we are advised, be one of the most up-to-date buildings in London.

Marylebone.—The B.C. has accepted tenders for annual supplies as follows :—

Rands & Co.—Ceiling roses, tumbler switches.
T. L. Scott & Co.—Tumbler switches, distribution boards and fuses.
Edison & Swan Co.—Wall plugs and sockets, switch plugs, distribution boards and lampholders.
Union Electric Co.—Flame lamp carbons.

Middlesex.—The County Council has accepted the tender of Messrs. Dick, Kerr & Co., at £429, for the laying of a double instead of an interlacing line in High Road, Willesden.

Power Machinery for Rand Mines.—The resident engineers have approved of the plans, and the local board of directors, at Johannesburg, of the Randfontein Mines, Ltd., have accepted the tender of the Gilbert Little Co., Ltd., Bradford, for an arrangement of transmission machinery for power and materials. The contract includes about a dozen motors from 5 to 35 h.p., with the gearing and steel structures, and a like number of "Bradford" patent transporters, elevators, and various designs of conveyors, to transport the auriferous ores from the mines to the crushers, thence in the reduced state to the batteries of stamps, from which trough-conveyors carry the finely-powdered ore to the cyanide part of the process—the tailings and attal being removed by aerial ropeways, or belt conveyors, and deposited on the waste heaps.

Salford.—The T.C. has accepted the following tenders for annual supplies :—

W. Lucy & Co., Ltd.—House-service cut-outs.
Liverpool Electric Cable Co.—Rubber-covered cable.
W. T. Glover & Co., Ltd.—Paper-insulated cable.
C. Macintosh & Co., Ltd.—Twin workshop flexible.

It has further accepted the following tenders :—

British Westinghouse Electric Co.—Installation of electric light at the Wellington Street School, £146.
Thames Engineering Co.—Combined evaporator and distiller required in connection with the new battery "make-up" water, £59.

Sunderland.—The T.C. Tramways Committee has accepted the tender of the United States Metallic Packing Co., for a rail-grinding machine.

Walthamstow.—The U.D.C. has provisionally accepted the following tenders :—

General Electric Co., Ltd.—Feeder booster set, £468.
Bertram Thomas.—Switchboard, £242.
General Iron Foundry Co., Ltd.—Constructional ironwork for extension of switchboard gallery, £87.

FORTHCOMING EVENTS.

Royal Institution.—Saturday, June 4th. At 3 p.m. Lecture on "Electric Heating and Pyrometry," by Prof. J. A. Fleming (Lecture I).

Physical Society.—Friday, June 10th. At 8 p.m. At the Imperial College of Science, South Kensington, S.W. Papers on "A Galvanometer for Alternate Current Circuits," by Messrs. W. E. Sumpner and W. C. S. Phillips; "The Positive Electrification due to Heating Aluminium Phosphate," by Mr. A. E. Garrett.

Municipal Electrical Association.—The Fifteenth Annual Convention will be held at Glasgow, June 14th to 17th. Particulars given in our issues of May 27th and April 8th.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

The following orders are announced :—

Commanding Officer—Col. R. E. B. Crompton, C.B.

Monday, June 6th.—"A" Company. Recruits' infantry drill, 6 to 6.45 p.m.; technical drill, 7 to 9.30 p.m.
Tuesday, June 7th.—"B" Company. Technical drill, 7 to 9.30 p.m.
Wednesday, June 8th.—Gymnasium, 6 to 9.30 p.m.
Thursday, June 9th.—"C" Company. Recruits' infantry drill, 6 to 6.45 p.m.; technical drill, 7 to 9.30 p.m.
Friday, June 10th.—"D" Company. Recruits' infantry drill, 6 to 6.45 p.m.; technical drill, 7 to 9.30 p.m.
Saturday, June 11th.—Musketry at Runemede. This course is now compulsory, please send name in as soon as possible for this shoot. Next shoot after this, July 30th.

(Signed) P. H. Campbell, Capt. R.E., Adjutant.
For O.C. E.E., L.D.

Braking A.C. Motors.—The provision of a quick stoppage is an advantage hitherto restricted to D.C. motors, which can act as generators; with A.C. induction motors the braking must be produced by external means. A suggestion of Mr. A. Héreng is given in *L'Industrie Electrique* for removing this drawback, by providing a suitable excitation for the stator of an induction motor during the act of stopping, which enables the rotor to generate alternating currents and thus to absorb energy. The desired end may be attained by coupling a small series D.C. machine to the motor, connected so that when the main circuit is opened, the D.C. machine is coupled to one of the stator phases and excites the field, while the rotor is either short-circuited or connected to a resistance. Alternatively a rectified current derived from one of the rotor phases (in the case of a wound rotor with slip-rings) may be used to excite the stator field, the current being rectified either by an electrolytic valve, a commutator, or other means.

China.—The British Consul at Wuhu reports that the Wuhu Electric Light Co., which is Chinese owned and under Chinese management, commenced operations in May, 1909, and now maintains a regular supply to some 4,000 lights in the native city. Additional machinery has lately been imported with a view to providing a night and day supply, and a scheme is on foot to make use of electric current as the driving power of the rice-cleaning machinery in one of the local mills.

NOTES.

Electrical Fatalities in Mines.—An inquest was held on Wednesday into the death of Henry Colburn, 23, who was killed by electric shock while working an electrically-driven coal-cutter at Normanton on Monday. Colburn put his foot on a steel hauling rope which, owing to leakage, had become "alive." He was wearing leather boots and was killed immediately. A fellow-workman who was wearing wooden clogs also trod upon the rope, but received only a slight shock. The jury returned a verdict of "Death from paralysis of the heart, due to a severe electrical shock."

On the night of June 1st, says a daily paper, Edward Abbott, a surface foreman, was killed by electric shock at Glamorgan Colliery Yard, Rhondda Valley. A horse, it seems, came in contact with a live wire, and fell dead. Doel, its driver, who held the leading chain, received a shock, and fell unconscious upon the horse. Abbott came to the assistance of Doel, but in leaning over one of the trams, received a shock, and was at once killed. Doel recovered.

Japanese Sympathy.—The following communication, which has just reached us from Japan, will, we are sure, be very highly appreciated by every British reader. In it we find evidence of the esteem in which our late Ruler was held in Japan, of the regard of our Far Eastern allies for us, deepening into actual grief, in a season of national bereavement, and of a fine and delicate feeling which makes that grief not a merely national expression on the part of the Japanese as a whole people, but also a personal one between business and private parties in the two countries. May this friendliness between us long continue and increase:—

"Tokyo, May, 1910.

"The sad news of the demise of His Majesty King Edward the Seventh, which reached here early Saturday morning, cast a deep gloom all over the country. The people are grieved just as much as if they had incurred the loss of one of our Imperial personages. We beg to express our profound sympathy with you in this sorrowful event.

"Very sincerely yours,
"THE MARUZEN-KABUSHIKI-KAISHA."

Copper.—The Austro-Hungarian copper wire kartell, which, after 10 years' existence, expires on June 10th, will, says *Elektrotechnik und Maschinenbau*, in all probability, not be renewed, since the firm of Siemens & Halske, at Leopoldau, have set up their own rolling mills. This works uses some 150 wagon loads alone, while from the other members of the Union only 400 wagon loads yearly have hitherto been placed on the market; this is exclusive of their output for their own consumption.

Appointments Vacant.—Man to take charge of public arc lamps for Bermondsey Council (45s.); assistant masters in electrical and mechanical engineering respectively for the Kent Education Committee (£120); overhead lineman for the Falkirk and District Tramways Company; clerk for the Swindon Corporation Electricity and Tramway Departments (£75). Traffic superintendent for the Burton and Ashby Light Railways (£130). See our advertisement pages in this issue.

Electroplating Aluminium.—It has hitherto been found impossible to produce a lasting coat of metal on aluminium for the purpose of protecting the latter against attack by alkalis such as salt, saltpetre and soda. Many patents have been taken out on the subject, but none of them have led to practical results—the coating, in all cases, flaked away in time. Messrs. Mix and Genest, of Berlin, have found that this behaviour is owing to the presence of a coating of oxide on the aluminium, and that if this oxide is first removed aluminium behaves like other metals, and allows itself to be permanently coated with copper, nickel, silver or gold without difficulty. The above firm has discovered a simple way of removing the oxide from the aluminium, and has thus been able to produce very good and permanent coatings. For instance, some aluminium spoons coated by this process were boiled for 8 hours in a 3 per cent. solution of caustic soda, and then allowed to lie in the cold solution for another 36 hours, without any signs of flaking, although at places where the coating had been previously intentionally removed the aluminium was completely eaten away. This test compares with the treatment which household articles would meet with in a year and a half or two years of washing with soda, &c. Several firms have taken out licences for the process, and electroplated aluminium articles will shortly be on the market.—*E.T.Z.*

Electricity in Agriculture.—Prof. J. Kühn, of Halle University, has recently brought a series of experiments in electroculture to a close. Full details are to be published later, but apparently the tests show that little improvement resulted from the use of electricity. The methods employed were those introduced from England; and although the growth of the plants was considerably increased and accelerated, the final yield was entirely normal. In some cases the electrified portions of cornfields and grass plots showed, in fact, poorer results than the untreated portions. In the case of beets for cattle and for sugar manufacture, however, a small improvement in yield resulted. Potatoes and clover were uninfluenced—at least, not influenced sufficiently to pay for the application of electricity, which cost about 10s. an acre. Prof. Kühn will probably repeat the experiments on the same fields for the sake of greater certainty.—*E.T.Z.*

Ductile Tungsten.—In a paper read last month before the American Electrochemical Society, Dr. Colin G. Fink, of the Research Laboratory at Schenectady, New York, gave some very interesting information relating to the production of ductile tungsten at that laboratory, the announcement of which appeared in these columns several weeks ago. The paper also treats of ductile molybdenum, the title being "Ductile Tungsten and Molybdenum."

The author states that tungsten, which has the highest melting point of any metal (3,000° C.), has ordinarily been obtained in commerce in the form of a dark grey power, usually from the reduction of the oxide by hydrogen or by carbon. As obtained in the open market, this powder is generally impure, and is purified by various well-known methods, particularly if the metal is to be used for filaments for incandescent lamps. It is stated, however, that even in ordinary commercial lamps the tungsten filaments are of a degree of purity so high that no impurities can be discovered by the most searching methods known to chemical analysis; moreover, the filaments during the course of commercial production are exposed to temperatures high enough to drive out by mere vaporisation almost any conceivable impurity. Nevertheless, such filaments show no traces whatever of ductility or even pliability; but, on the contrary, though strong enough for mounting in commercial lamps, they are exceedingly brittle and incapable of taking a permanent set.

The paper sketches the attempts hitherto made to produce ductile tungsten by various purification processes, all without success; it has generally been concluded that the metal is entirely lacking in that physical property which is ordinarily called ductility. The result of the work at Schenectady has been the production of tungsten in a form in which it is ductile, and which, it is stated, would seem to be a new substance from the point of view of the physical chemist. The material is a bright, tough, steel-coloured metal, which can be drawn into the finest wire, much below $\frac{1}{1000}$th in. The tensile strength of the wire increases as the drawing proceeds, or, in other words, the more the metal is mechanically worked the tougher it gets. A table included in the paper gives a tensile strength varying from 490,000 lb. per sq. in. for a wire 0·005 in. in diameter to 610,000 lb. for a diameter of 0·0012 in.

The density or specific gravity of ductile tungsten increases similarly with the amount of working, varying from a value of 18·81 before drawing to 20·19 for a wire 0·0015 in. in diameter. The resistivity for tungsten was found to be 6·12 for hard-drawn wire and 5 for annealed wire; the resistivity of copper is 1·59. The temperature coefficient of the former is (between 0° and 170°) 0·0091, and of the latter, 0·0045.

The drawn wire retains its lustre almost indefinitely. Acids, such as hydrochloric, nitric and sulphuric, attack tungsten very slowly; fine-drawn tungsten, when heated in a mixture of chromic and sulphuric acid for 16 hours, shows only a very small loss in weight.

In concluding the paper Dr. Fink states that in the work to which it relates, which was carried out at the Research Laboratory of the General Electric Co., of Schenectady, a number of chemists and research men participated, foremost among whom was Dr. Coolidge.—*Electrical World.*

Southwark Carbon Contract.—We have received the following letter:—

"On page 868 of your last issue (No. 1,696) we observe that it is stated that the committee of the Southwark Borough has accepted the option of continuing an arrangement entered into in March of last year with the Union Electric Co. and ourselves, for the supply of flame carbons at the price then in force. We write to state that the notice is quite incorrect, as we have no contract running at present with the Southwark Borough, and we shall be glad if you will kindly insert in your next issue a notice to this effect.

"SLOAN ELECTRICAL CO., LTD.
"JOHN M. SIM, *Secretary.*"

We have fully inquired into this matter, and find that the information published by us last week is exactly as it appeared in the Southwark Council's minutes. The error occurred, we are informed, in the preparation of the minutes.

Admiralty Electrical Appointments.—New regulations have been approved by the Admiralty for the appointment of electrical engineers, and of first and second assistant electrical engineers at the Admiralty and in the Royal Dockyards. Vacancies for electrical engineers will be filled by selection from the grade of first assistant electrical engineer. Vacancies for first assistant electrical engineers will be filled by selection from one or other of the following classes:—Assistant electrical engineers—Dockyard employés who have held the Admiralty scholarship; outside candidates, who will be required to produce evidence of having passed through a course of engineering study in a University technical college, or other educational establishments, to the satisfaction of the Admiralty, and of having been engaged in practical engineering work for at least five years, part of which must have been spent in a responsible position as electrical engineer. As a rule every second vacancy will be filled by the appointment of an outside candidate. Appointments in vacancies for second assistant electrical engineers will be made by means of a competitive examination at which inspectors or electrical fitters and first-class draughtsmen of three years' seniority, and persons qualified by Admiralty scholarships, will be eligible to compete, provided they are under the age prescribed by the Home Dockyard Regulations at the date of the examination.

Institution and Lecture Notes.—RAILWAY SIGNAL AND TELEGRAPH ENGINEERING INSTITUTE.—The last meeting of the season was held at the St. Marylebone Church Institute on May 30th, Mr. W. J. Thorrowgood in the chair. Mr. F. W. R. May gave a lecture on "Automatic Relays and Switches as applied to Telephone Installations," touching also upon automatic relays for signal work. A discussion followed, in which many members took part. The chairman, in a concluding address, said he trusted that the movement would continue to make the progress in the future that had attended it during its first season. The meeting thanked Mr. Thorrowgood for the support he had given the movement from its start.

COMMITTEE FOR THE PROTECTION OF ELECTRICAL INTERESTS.—At a meeting of the committee held at Faraday House on the 25th ult., Mr. Robert Hammond in the chair, Mr. Arthur Preece was elected hon. treasurer, and Mr. R. Borlase Matthews, who has acted as hon. secretary *pro tem.*, was elected hon. secretary of the committee.

INSTITUTE OF METALS.—The Council of the Institute has decided to undertake an investigation into the causes of the corrosion of non-ferrous metals by sea water, acids, &c., and by other chemical and electrolytic reactions. A Committee has been appointed for the purpose of carrying out the investigation. The Committee has decided, in the first instance, to confine its attention to the question of the corrosion of condenser tubes in marine engines and in stationary engines using foul water or subject to violent electrolytic action, such as often occurs in electric power stations. Prof. H. C. H. Carpenter, of the University of Manchester, has undertaken to act as honorary secretary to the Committee. The result of the Committee's researches will be at the disposal of the members of the Institute of Metals.

INSTITUTION OF GAS ENGINEERS.—The annual general meeting of the Institution is to be held on June 14th to 16th. A paper on "Public Lighting from a Municipal Point of View," by Mr. Jacques Abady, of London, will be read and discussed, which, in view of recent occurrences, should be of interest to electrical engineers.

INSTITUTION OF ELECTRICAL ENGINEERS.—At the annual general meeting, held on May 26th, the report and accounts were adopted. As the result of the ballot in connection with the election of five new members of Council, to which we refer in our leader columns, Messrs. MacMahon, Pearce, Dickinson, Morcom and Faraday Proctor were declared elected. At the special general meeting held the same evening, to approve of the expenditure of an additional £10,000 in connection with the Institution building, Mr. Hammond, in dealing with the resolution, explained that the members had at previous meetings sanctioned the expenditure of £50,000 and £20,000 on the purchase of the lease of the Embankment building and the necessary structural alterations involved in making it suitable for the requirements of the Institution, particularly with regard to the theatre. Over and above the sum of £70,000 already sanctioned, however, there was a debit on current expenditure upon the building fund of £1,170 3s. 7d., due mainly to expenses connected with the mortgage obtained on the building and the loss on the sale of the securities, and the Council therefore thought that, to put themselves strictly in order, the members ought to be asked to sanction that excess. It was thought advisable, however, to get sanction for the much larger sum of £10,000, because in three or four years' time the medical authorities might vacate the upper portion of the building at present occupied by them; and if some expenditure on structural alterations was then necessary to meet the requirements of new tenants, the Council desired to have the power to spend that money without going to the trouble of calling another special meeting.—Mr. R. K. Gray seconded the motion, which was unfavourably criticised by Mr. W. B. Esson. Mr. Hammond, in reply, said the Council had no idea whatever of spending the £10,000 upon the building at the present time; they looked upon it as a nest-egg, which would be available for dealing with that part of the building not occupied by the Institution.—The resolution was carried unanimously.

ASSOCIATION OF ELECTRICAL ENGINEERING STUDENTS, L.C.C. SCHOOL OF ENGINEERING, POPLAR, E.—The second meeting of the above Association was held on Wednesday evening May 25th, when, before a large audience, a paper was read by Mr. W. S. Ibbetson, B.Sc., A.M.I.E.E., on "Hydro-Electric Power Plants." The relative advantages of steam and water-power were first discussed, followed by a general description of the construction of different types of power plants on the Continent and in America. In conclusion, three of the largest water-power plants of the world were described and illustrated by a very large number of slides. The next meeting will be held on June 22nd, when a debate on "Gas *v.* Electricity" will take place.

EAST LONDON COLLEGE.—A course of three special lectures on "The Illumination of Interiors," by Profs. J. T. Morris and C. A. M. Smith, will be delivered on Wednesday evenings, June 8th, 15th and 22nd. Further particulars appear among our advertisements to-day.

THE CANADIAN ELECTRIC ASSOCIATION.—This Association will hold its annual Convention at Muskoka Lakes, Ontario, on July 6th, 7th and 8th. A very interesting programme has been arranged, and some of the leaders in the electrical industry, and the prominent men in the United States and Canada, are expected to be present. Our Correspondent writes:—"In addition to the papers and discussion, the attendants at this Convention will have an opportunity of a most pleasant holiday, as there is no more beautiful spot in Canada in the summer season than the renowned Muskoka Lakes. This is a good opportunity for friends over seas to combine pleasure with profit by attending the Convention."

Fire.—According to the *Glasgow Evening Times* damage to the extent of several thousand pounds was caused on the night of May 26th by a fire in the works of Messrs. Bruce Peebles & Co., Ltd., East Pilton, Edinburgh. The outbreak occurred in the varnishing department, a building measuring 27 ft. by 9 ft., which was gutted, a large number of dynamos and other electric stock, and a considerable quantity of varnish and other material being destroyed. The fire for a time was of an alarming character, but soon after midnight the brigade had it under control.

Athletic Sports.—On Wednesday evening, May 25th, the second annual sports of the Electrical Engineers (London Division) took place on the London County Athletic Grounds, Herne Hill. Major A. E. Le Rossignol, who has presented the corps with a challenge cup for the best company aggregate, acted as referee, and the prizes were distributed by Mrs. Le Rossignol. The various events comprised 100 yards level race and 800 yards level running race, cycling races, high and long jumps, hurdle racing, tug-of-war, &c. The swimming events took place on the preceding Saturday, May 21st, at the City of Westminster Baths. Major Leaf is president of the Sports Committee, Q.M.-Sergt. G. A. Applebee, hon. sec., and Sergt. D. C. M. Hume, assist. hon. sec.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—MR. S. WHITEHOUSE, senior shift engineer at Smethwick Power Station (Birmingham and Midland Tramways Joint Committee), has been appointed superintendent of sub-stations to the Walsall Corporation.

The Ilford U.D.C. has increased the salary of MR. A. GLAZIER, charge engineer, from £97 10s. to £120 per annum; and that of MR. J. AVICE, charge engineer, from £85 10s. to £108.

The Lighting Committee of the Brighton T.C. has recommended that the salary of MR. G. CLOUGHTON, power house superintendent at the Southwick works, be raised from £260 to £300 per annum. In his report to the Committee, the manager speaks highly of the efficient service Mr. Cloughton has rendered.

MR. W. PHETHEAN, late senior shift engineer, has been appointed chief assistant electrical engineer to the Farnworth U.D.C.

Tramway Officials.—The South Shields Tramways Committee has recommended the Council to increase the salary of MR. HARVEY, the tramways manager, from £250 to £300 forthwith, rising to £350 by two further annual increments of £25.

The Wigan T.C. is to engage MR. C. W. MALLINS, the general manager of the Liverpool Corporation Tramways, to report on the whole question of the working of the tramways.

General.—On the occasion of his marriage last week, MR. W. LUNN, A.M.I.E.E., was the recipient of a case of silver spoons from his colleagues at Messrs. Siemens Bros., Caxton House, S.W. His wife (*née* Miss F. M. Saville) received from her late employer, Mr. P. J. Mitchell, a silver vase, and from her colleagues a silver cruet.

The *Review of the River Plate* states that MR. N. E. DAVIS, submanager of the United River Plate Co., is shortly leaving to take up the post of manager of a land company in Monte Video.

MR. J. J. CHISWELL is shortly resigning his position with the Brush Electrical Engineering Co. to take up the position of sales manager to the "Imperial Lamp Works (Brimsdown), Ltd." His new address will be Kingsway House, Kingsway, W.C.

DR. J. A. HARKER, PROF. B. HOPKINSON and MR. F. SODDY have been elected Fellows of the Royal Society.

MR. E. E. TASKER, M.I.E.E., A.M.I.Mech.E., has been appointed to the post of chief engineer to the A.E.G. Electric Co., in London.

MR. F. W. HARTMANN, A.M.I.E.E., has resigned his position as assistant managing director of the Langdon-Davies Motor Co., Ltd., and is not now actively connected with the company.

Obituary.—MR. ALFRED COLSON, M.Inst.C.E., M.I.E.E.—We regret to record the death of Mr. Alfred Colson, the Corporation gas and electrical engineer at Leicester. As our readers are already aware, Mr. Colson had lately undergone an operation at a nursing home in London, but he passed away last week at his home at Leicester. It was some 28 years ago that the deceased gentleman entered the service of the Corporation to overwatch its gas supply interests, and later, when electricity supply was added to the other municipal interests of the city, he took the helm of that undertaking also, the works being opened in 1894.

MR. HORACE ALFRED STEWART.—The death has occurred of Mr. H. A. Stewart, assistant electrical engineer at the Cape Copper Works, Swansea, who was drowned off the Mumbles on Sunday afternoon whilst yachting. A squall struck the craft just after rounding Mumbles Head on the return journey. Deceased was only 27 years of age. He went to Swansea from Southend some three years ago. At the inquest the jury returned a verdict of "Accidental death," and expressed sympathy with the relatives.

MR. AUGUST KRAUSS.—The death has occurred of Mr. A. Krauss, of Bristol, the well-known tramway contractor. He carried out the contracts for the construction of the tramways at Bristol, Newport, Darlaston, York, Bath, and many other places.

NEW COMPANIES REGISTERED.

Harper Electric Piano (1910) Co., Ltd. (109,862).—This company was registered on May 27th, with a capital of £30,000 in 28,000 participating ordinary shares of £1 each, and 20,000 deferred shares of 2s. each, to take over the business of the Harper Electric Piano Co., Ltd., to acquire land at Islington and erect an electric theatre, public hall, skating rink and café, to carry on the business of automatic and general musical instrument manufacturers, theatre and hall proprietors, suppliers of electrical pianos to cinematograph theatres and other places of amusement, &c. The subscribers (with one share each) are:—W. E. Garstin, Somerville Lodge, Elsworthy Road, N.W., gentleman: S. C. Harper, 258, Holloway Road, N., manufacturer; W. Harper, 258-262, Holloway Road, N., secretary; F. C. Godelmann, 94, Cannon Street, E.C., merchant; D. R. Thomson, 345 Finchley Road, N.W., manufacturer; J. E. Capel, 9, College Place, Camden Town, N.W., teacher of music; W. Bambrick, 14, Framfield Road, Highbury, N. Minimum cash subscription 20 per cent. of the shares offered to the public. The directors are to number not less than two or more than seven. S. C. Harper is the first managing director; qualification, £250: remuneration of ordinary directors according to profits. Registered office, 258-262, Holloway Road, N.

Transit Co., Ltd. (109,799).—This company was registered on May 24th, with a capital of £2,000 in £1 shares, to construct or acquire any tramways or light railways in the United Kingdom, to carry passengers and goods, &c. The subscribers (with one share each) are:—W. Brown, 18, Willoughby Road, Waterloo, Liverpool, accountant; J. A. Nicholson, 33, Barrington Road, Seacombe, Cheshire, clerk. Private company. Table "A" mainly applies. Registered office, Atherton, Lancs.

"Cedes" Electric Traction Ltd. (109,698). — This company was registered on May 18th, with a capital of £2 000 in £1 shares, to carry on the business of electricians, electrical engineers, manufacturers of and dealers in motors, coaches, carriages, tramcars, locomotives, carts, wagons, ships, boats, launches, cycles, and airships, &c. The subscribers (with one share each) are:—G. F. Underwood, 15, Cockspur Street, S.W., company director; K. D. Bowers, Sutherland House, Surbiton, electrical engineer. Private company. The subscribers are to appoint the first directors; no qualification required. Registered office, 15, Cockspur Street, S.W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Gell Telegraphic Appliances Syndicate, Ltd. (78,405).—Mortgage dated April 29th, 1910, to secure £1,600, charged on certain patents and inventions and the syndicate's general assets, present and future. Holders: C. M. Gonne, Mrs. J. Gonne and H. Gonne.

Lancashire Dynamo and Motor Co., Ltd. (61,447).—Issue on March 21st of £100 debentures, part of a series of which particulars have already been filed.

Northwood Electric Light and Power Co., Ltd. (66,312).—Particulars of £5,000 debentures, created April 6th, 1910, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £1,725. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Howe Electrical Engineering Co., Ltd. (105,542).—Particulars of £500 debentures, created by resolutions of May 13th and 19th, 1910, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount now being issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Indian Electric Supply and Traction Co., Ltd. (84,233).—Trust deed dated May 10th, 1910, to secure £50,000 debenture stock. Property charged: Cawnpore undertaking and other assets, present and future, appertaining thereto. Trustees: K. A. S. Moncrieff, Salisbury House, E.C.; and E. H. F. Reeves, Gordonstone, Moss Hall Grove, North Finchley.

Bradbury & Co., Ltd. (8,327).—Return dated March 1st, 1910. Capital £90.000 in £6 shares. £12,631 shares taken up. £6 per share called up. £83,073 received, including £7,287 paid in advance of calls. Mortgages and charges: First mortgage, £5,653; 4½ per cent. debenture stock, £84,988.

Balchin, Schulz & Co., Ltd.—Particulars of £1,000 debentures, created May 13th, 1910, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £500. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

South Metropolitan Electric Light and Power Co., Ltd. (47,875).—Return dated March 14th, filed April 4th. Capital £500,000 in 250,000 ordinary, 100,000 second preference and 150,000 first preference shares of £1 each. 123,000 ordinary, 50,000 second preference and 142,968 first preference shares taken up. £1 per share called up on 120,500 ordinary, 50,000 second preference and 137,600 first preference. £308,100 paid. £7,868 considered as paid on 2,500 ordinary and 5,868 first preference. Mortgages and charges: £240,000.

Simplex Conduits, Ltd. (88,290).—Return dated March 24th, filed April 6th. Capital £100,000 in 10,000 preference shares of £5 each, and 50,000 ordinary shares of £1 each. 10,000 preference and 40,000 ordinary shares taken up. £50,000 paid on the preference. £40,000 considered as paid on the ordinary. Mortgages and charges: Nil.

W. H. A. Robertson & Co., Ltd. (95,906).—Return dated March 21st, filed March 31st. Capital, £16,000 in £10 shares (1,000 preference), 300 ordinary, and 300 preference shares taken up. £10 per share called up on 300 ordinary, £4 15s. per share on 20 ordinary, and £10 per share on 300 preference. £6,195 paid. Mortgages and charges: Nil.

St. James' and Pall Mall Electric Light Co., Ltd. (26,015).—Return dated March 1st, filed March 11th. Capital, £300,000 in 40,000 ordinary and 20,000 preference shares of £5 each. All shares taken up. £298,250 paid on 39,650 ordinary, and 20,000 preference. £1,750 considered as paid on 350 ordinary. Mortgages and charges: £150,000 3½ per cent. debenture stock, and £205,472 4 per cent. guaranteed stock of the Central Electric Supply Co., Ltd. (being half the total loan capital).

J. L. Manufacturing Co., Ltd. (99,613).—Particulars of £10,000 debentures, created April 15th, and secured by trust deed dated May 18th, 1910, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £6,000. Property charged: Certain freehold and leasehold hereditaments at Southall, and the company's undertaking and property, present and future, including uncalled capital. Trustees: B. Harman.

CITY NOTES.

Shanghai Electric Construction Co., Ltd.

The directors in their report for 18 months to December 31st, 1909, the commencement of which period coincides approximately with the date at which the whole of the tramway system was in effective operation, state that the accounts show a loss of £949 on 18 months' working, before making provision for depreciation. The result is, at first sight, somewhat disappointing, but the following table of figures shows that progress has been made:—

For the quarter ended	Gross receipts at par of exchange.	Amount realised after deducting loss by exchange.	Passengers (*i.e.* tickets issued.)
	Mex. $	Mex. $	
September, 1908 ..	115,733	97,733	2,691,186
December, 1908	119,298	101,111	2,686,065
March, 1909	131,476	107 982	2,688,831
June, 1909	136,688	108,564	2,696,254
September, 1909.. ..	146,275	114,938	3,015,412
December, 1909	156,244	122,456	3,482,218
March, 1910	157,326	124,960	3,719,190

The tramway service has been conducted under considerable difficulties, the chief of which has been the heavy fall which has occurred, since the tramway concession was granted, in the value of the small currency, in which about four-fifths of the traffic receipts are collected. This loss by exchange amounted to no less than £13,341 during the 18 months. There is, unfortunately, no indication at present of improvement in the value of this currency.

It was intimated in the report, dated December 8th last, that arrangements were being made with the Municipal Council to convene a special meeting of ratepayers to consider certain alterations in the concession in favour of the company, with a view to improving the conditions under which it is working. Negotiations with the Council were, however, prolonged into the present year, and, instead of a special meeting being convened, the proposed alterations were submitted to the annual meeting of ratepayers, held on March 21st last. The company's requests included a reduction in the Council's charge for power, relief in perpetuity from the cost of road maintenance, and relief from the royalty of 5 per cent. on the gross receipts. These requests were sympathetically considered by the Council, and notwithstanding the fact that these concessions were supported by the chairman of the Council at the meeting, the few ratepayers who were present rejected two out of the three, and the only alteration which the company secured is the substitution of a new scale of charges for power, which will afford some small measure of relief as traffic develops and the consumption of power increases. Permission was received from the Municipal Council last year to employ six trailer cars experimentally. Two of these were sent out from home and are working satisfactorily, and four have been put in hand for manufacture in Shanghai. The Council has authorised additional trailers as required, and these additions will be gradually introduced as funds permit. An application for leave to divide each of the existing fare sections into two has also been granted. It is hoped that these further facilities, with the introduction of overlapping sections and rearrangement of fares, will result in improved traffics. It has not hitherto been practicable to put into operation the agreement with the French tramway company in Shanghai for a through service over the lines of both companies. The delay is due to causes for which the company is not responsible, but recent advices state that this matter can now be satisfactorily settled, and that through running will commence as soon as possible. Some improvement in receipts is anticipated from this source.

Sir Alfred Dent presided, on Thursday of last week, over the fourth annual meeting of this company, held at Basildon House, Moorgate Street, E.C.

The Chairman, in moving the adoption of the report, said they would remember that their last meeting was held on December 16th, when they were actively pursuing negotiations with the Municipal Council in Shanghai towards a modification of the terms of the concession—for a reduction in the price charged for power, for relief from road maintenance, and for a reduction or abolition of the royalty of 5 per cent. on gross receipts, so as to put them on an equality in this respect with Hong Kong and Singapore. These prolonged negotiations with the Council resulted in their consenting to the abrogation of the company's liability for road maintenance, to a suspension of the royalty for the year 1910, and also to a slight concession in cost of power. The Budget for 1910 was drawn in accordance therewith, and these concessions were strongly supported by the chairman in his address to the ratepayers at the annual general meeting on March 21st last. To their surprise, the ratepayers declined to support the recommendations of the Council and its chairman, and the proposals as regards road maintenance and royalty were rejected. By far the most important source of trouble, as shown in the accounts, had been under clause 22, by which the collection of fares, though authorised in Mexican cents, had had to be made in native currency, which had depreciated continuously and at an increasing rate since 1905. The charge put upon them for maintaining the public roads through which the lines were laid was certainly unfair, since experience had proved that the considerable wear and tear of these roads, including the costly tramway track, which was so much patronised by vehicles of all sorts owing to its better surface, was caused entirely by the general traffic, and not by the electric cars, which run on the rails only. He would not detain them longer over the disappointment they had had at this adverse vote of the ratepayers. As it stood, it had the double effect of retarding the improvement of the service for the benefit of the community and of delaying the date for a return to the shareholders on the large capital they had expended. They had no alternative at present but to accept the decision and do the best they could to live under it. The capital expenditure at the date of the accounts comprised:—On construction account, £301,072; land and buildings adjoining car-shed, £8,909; general equipment, £9,876; making a total of £319,857.

On the other side of the balance sheet the sundry creditors were almost entirely made up of trade liabilities in Shanghai, including the Council's power account and royalty. The balance of £6,000 shown as due to the contractors represented the sum for which the company compromised the contractors' claim under the works contract for a larger amount. The £6,000 had since been paid. The bank loan, which at the date of the accounts stood at £26,000, was now £33,000, and, apart from current trade expenses, the bankers were their only creditors. In the profit and loss account the trading results had been exhibited under standardised headings, and fuller particulars of the expenditure under each heading were exhibited in the accompanying abstracts. At the meeting held on December 16th, 1909, they gave the shareholders the gross and net receipts, as estimated up to the end of the year; the actual receipts were now included up to the end of March last, and rendered in quarterly figures, as being more convenient for purposes of comparison than monthly figures. There was an increase both in gross and net receipts in every quarter; but these receipts had been more than absorbed in expenses, and the result over the whole period was a loss of £949, without making any provision for depreciation. The loss in exchanging the native currency into Mexican dollars alone accounted for £13,341, besides which they had paid away to the Council £2,774 in shape of royalty, and a substantial sum for the maintenance of the public roads through which their tramways ran. These three items made a heavy total, and represented the dead weight they had had to carry for the last 18 months. The largest item on the debit side was power expenses £15,923, in reference to which they were to be allowed only a fractional reduction in future, notwithstanding their very large account, which cost nothing to collect, whereas a large reduction was announced in March, 1909, to private consumers, numbering over 3,000. Possibly they alone were refused the benefits extended to others (since January 1st, 1909) on account of the profit of the Electricity Department for 1909 not having realised expectations, there being a shortage of 16,500 taels, for various causes, on the Budget estimate. No estimate seemed to have been included by the Department in the 1910 Budget. They had had no further remittance from Shanghai since their meeting in December last. The £4,000 then referred to as sent from Shanghai represented practically a remittance to pay for stores sent from London, which would otherwise have had to be purchased in Shanghai. £5,000 worth of stores were included under the works contract. The statistics showed that they had, as before, 25 miles of single track in operation on 16½ miles of route, 65 tramcars in use (though some of these were usually held in reserve or under repair), and two trailers built at home, which had given satisfactory results. They had carried during the 18 months 17,143,916 passengers, and run 3,012,686 car-miles. The receipts for the 12 months of 1909 averaged 4·69d. per car-mile, against 3·81d. for the second half of 1908; the fare per passenger averaging over the same period ·79d., against ·75d. The number of trailers was being increased as funds permitted, the Council having recently sanctioned more of them. They had also sanctioned a sub-division of fare sections, which they trusted would result in improved traffics a few months hence. As regarded the agreement with the French tramway company for a through service over both lines, they had no information beyond what was given in the report, but would be glad to see this carried out. While on the subject, it was as well to point out that the original intention of extending their system into the French settlement, as referred to in the prospectus, was abandoned, as they were all aware, when the French authorities decided to have a system of their own. As to the future of their tramways, notwithstanding their present difficulties and the unmerited set-back which they had suffered at the hands of the ratepayers, he was confident that, with the support of the community, they would eventually bring their work to a successful issue, the receipts for some time past showing a steady surplus over working expenses. Expenses in London would be reduced in the next account, as the directors had decided to draw only half of their fees for 1910. The administration in Shanghai was carried on with due regard to economy and efficiency.

Mr. J. S. Haskell, in seconding the motion, said that they hoped that, with patience and perseverance, they would surmount their difficulties. The chief thing they had to contend with was the shrinkage in the value of the Chinese money. The Government of China were, however, considering a scheme for placing the value of money on a sound footing. If such a proposal should become law, it would be a good thing for the company, as they had lost some hundreds of pounds a year through the shrinkage.

The report was adopted.

Imperial Tramways Co., Ltd.

Addressing the annual meeting of this company at Bristol on Tuesday, Sir George White (as reported in the *Financial News*) said that for 16 years the ordinary share dividends had averaged 10 per per cent. in cash, apart from the distribution of bonus shares, so that the absence of any dividend now was naturally more unpalatable. This absence of dividends was due to their having received no dividend on their holding of preference shares in the London United Tramways. When the London United resumed payment of even half its preference dividend the Imperial Co. would at once be able to pay its preference dividend in full. The London United system was undoubtedly a valuable property, having even now, in spite of competition, a gross income of well above £300,000 and a net revenue of between £90,000 and £100,000 a year. The fact that the traffics were £10,000 up on 21 weeks this year showed vitality. It had not the restricted outlook of a provincial concern, for with the marvellous growth of western London and its suburbs so many things were possible. For these reasons he felt that the market was unduly pessimistic in to-day assessing the whole of the company's debenture stock and share capital at less than £1,500,000 for a property upon which £3,500,000 in cash had been laid out during a comparatively few years. He believed the undertaking could be, and should be, pulled round. While, however, the market quotation of the London United holding showed depreciation so largely in excess of the Imperial Co.'s £130,000 reserve fund, it would be unwise to make any payment on account of Imperial cumulative preference shares. The report was adopted.

Brush Electrical Engineering Co., Ltd.

The directors' report for the year ended December, 31st, 1909, states that the general profit and loss account shows a gross profit of £22,529. After debiting general charges and maintenance, the amount carried to net profit and loss account is £1,812. Debenture and other interest charges, and bad and doubtful debts written off, have absorbed the sum of £23,042, leaving a loss of £21,231. As mentioned in the last report, the volume of business secured in 1908 was, owing to the severe trade depression, much below the average, and the amount of work in hand at the close of that year was small. The conditions at the beginning of the year 1909 were, therefore, unfavourable, and although the orders secured in that year showed a considerable improvement over the previous 12 months, it was not possible to make up for the shortage of invoicing during the earlier months. The year 1910 will benefit by the larger volume of unfinished work in hand at December 31st last. As compared with 1908, a reduction of over £16 000 has been effected in the company's general charges for the past year. This reduction is not directly shown in the accounts now submitted, because, at the close of 1908, certain departments previously carried on in London were transferred to Loughborough, thus bringing about changes in the allocation of the various charges before arriving at the gross profit. The directors regret that the depression which has so long affected the engineering industries of the country still continues, and although there has been some improvement of late, the demand for steam and electrical machinery, as well as for rolling stock, is still far below the normal, and the great competition renders the prices obtainable for the most part unsatisfactory. There has, however, been an increased output from the works during the first five months of the year 1910, and it is hoped that this increase, coupled with the reduced working expenses of the company, will lead to improved results. The directors report with satisfaction that the turbo-generators manufactured by the company have gained a high reputation, and good orders are being received for plant of this description to work with live, mixed pressure and exhaust steam. The company is interested in a variety of promising electrical and engineering developments.

The auditors, Messrs. Cooper Bros. & Co., in their certificate, say:—"The inventory of the stock has been taken by the employés of the company, and the summary signed by the secretary. The shares and debentures have, as to about one-half of them, published prices, and the values at such prices show a reduction upon the figures in the accounts. We are unable to verify the value of those not having published prices, about one-half of which appear to be of small value. During the year, certain of the patents have expired or been allowed to lapse. No provision has been made for depreciation during the three years ending December 31st, 1909."

The meeting is called for Monday next, June 6th, at No. 1, Kingsway.

Winnipeg Electric Railway Co.—The report for 1909 shows (says the *Times*) net earnings of $863,405 after providing for operating expenses, taxes, the City of Winnipeg's proportion of earnings, and other fixed charges. The directors declared four quarterly dividends amounting to $600,000, leaving a surplus of $263,405, which has been transferred to profit and loss, making a total credit to this account at December 31st, 1909, of $861,430.

Mirrlees, Bickerton & Day, Ltd.—The directors report that the profits for the year 1909 available for disposal amount to £5,577. They recommend that £4,000 be used in payment of dividend at the rate of 5 per cent., £1,000 being placed to reserve fund, and £577 carried forward.

Canary Islands.—The balance-sheet of the Société d'Electricité de Las Palmas for the last financial year shows a profit of £88,249, as compared with only £70,839 in the preceding 12 months.

Mackay Companies.—The directors have declared a quarterly dividend on the preferred shares and common shares of 1 per cent. and 1¼ per cent. respectively.

Siemens Bros. & Co., Ltd.—According to the financial Press, the directors, after allocating £23,600 for repairs to ss. *Faraday*, and £3 689 to pension fund, have declared a dividend of 4 per cent. (4s. per share) for the year to December 31st.

Prospectus.—*The Calgary Power Co.*—This company has been before the public this week with £256,800 5 per cent. first mortgage 30-year gold bonds to bearer at £92 per cent.

Bank Rate.—The Bank rate was yesterday reduced to 3½ per cent.

Typewriting Telegraph Corporation, Ltd.

A GENERAL meeting of the above company was held on Friday of last week at 72, Bishopsgate Street, E.C., Mr. Arthur J. Parker in the chair.

The CHAIRMAN said that he had so often spoken of their hopes and failures that there was very little for him to say. Their misfortune had been that they could not get the Government to take up the machine in which they were interested. He believed, and had always considered, that it was an exceedingly good thing as a machine, but, as he had said, it was no good unless it was taken up. The company had used the machine in a little way, but the patents had run out, and they had lost their royalties. They had got no customers in England, and they had spent a considerable amount of money in expeditions to France and America, in order to get people to take the machine up. The same thing applied to Austria and Italy. In Switzerland they had sold a few, and although the Director of the Military Department of that country had endeavoured to get his Government to take the machine up, he had not been successful. Previous to that meeting of the shareholders, the debenture-holders had met and unanimously passed three resolutions. The first instructed a liquidator to realise all the stock and assets of the corporation, the second appointed the liquidator as receiver of the property on behalf of the debenture-holders, and the third appointed the directors, Mr. R. W. Nash and himself, to act as an advisory committee to the liquidator. The ordinary shareholders had, therefore, no alternative but to put the concern into voluntary liquidation. He accordingly moved: "That it has been proved to the satisfaction of the company that it cannot by reason of its liabilities continue its business, and that it is advisable to wind up the same, and that the company be wound up accordingly."

MR. R. W. NASH seconded the motion.

Replying to a SHAREHOLDER, the CHAIRMAN said they did not anticipate that there would be any surplus after paying the debenture-holders.

Mr. Charles Samuel Beale, of 72, Bishopsgate Street Within, London, E.C., was appointed liquidator.

German Transmarine Electricity Co.

As was mentioned in this journal just a year ago, the Deutsch-Uberseeische Elektrizitäts Gesellschaft, of Berlin, is the most important German undertaking of its kind in the supply and investment branches in South America, and it has undergone further development in the meantime. During 1909 the share capital was raised from £3 600,000 to £4,000 000 by the issue of £400,000 in new shares, which yielded a premium of £79,000, which sum was placed to the reserve fund, whilst the bond capital was increased from £2,750,000 to £3,500,000. Since the close of the financial year the company has made a further emission of £500 000 in new shares, in order to provide funds for the redemption of floating liabilities and the payment for extensions. The accounts for 1909 show the following figures as compared with those for the preceding year:—

	1909.	1908.
Share capital	£4,000,000	£3,600,000
Bond capital	3,500,000	2,750,000
Gross profits	881,500	753,800
Interest on loans	165,900	128,700
Depreciation provision	148,000	104,400
Net profits and balance forward ..	417,300	390,500
Dividend	380,000	342.000
Dividend, per cent.	10	9½
Carried forward	12,200	11,600

The additional share capital issued in 1909 is only entitled to dividend for one-half of the year, so that the total ordinary capital participating represents £3,800,000. The rate of 10 per cent. compares with 9½ per cent. in each of the three preceding years and with 9 per cent. in 1905 and 8 per cent. in 1904.

The directors' report, in dealing first with the company's electric supply works at Buenos Ayres, states that the sales increased from 86·34 millions of KW.-hours in 1908 to 100·83 millions in 1909, and the connections advanced by 11,065 KW. to a total of 80,908 KW. In addition, the tramways served by the company, which had an average daily number of 1,510 cars in operation, absorbed 15,190 KW., as contrasted with 12,500 KW. in 1908. The capacity of the generating stations at the end of 1909 was 46,710 KW., and 29,330 KW. was installed at the transformer stations. The works at the large station at Avellaneda proceeded, according to the programme, and two turbo-generator sets, each of 7,500 KW., were erected by the close of the year, it being expected that the first plant of 30,000 KW. is now being set to work.

The leasing contract concluded with the Capital Traction and Electric Co., of Buenos Ayres, in 1905, had been abolished, but the Transmarine Co. effected a new agreement in March, 1909, with the Compagnie Générale de Tramways de Buenos Ayres, whereby the latter took up a lease of the Tramvia Metropolitano for the whole period of the concession until 1960, and undertook to pay a rental of £22,000 per annum for the first three years, and £25,000 per annum in subsequent years. At the same time the Belgian company was granted the right to purchase the tramway by the end of 1912, and it had since decided to exercise the option. The Transmarine Co. holds £650,000 in 6 per cent. preference shares, and £380 000 of ordinary shares in the Chilian Electric Tramway and Light Co., and has also advanced to it the sum of £364,000, whilst the former now owns the whole of the capital in the Valparaiso Electric Tramway Co., and has made advances totalling £728,000; and is also largely interested in the trans-Atlantic tramway at Monte Video and the Santiago hydro-electric works.

Potteries Electric Traction Co., Ltd.

THE twelfth ordinary general meeting of the shareholders of this company was held on May 26th at the Electrical Federation Offices, Kingsway, Mr. G. F. M. Cornwallis-West in the chair.

The CHAIRMAN, in proposing the adoption of the report, said that the position of the company last year might be at once summarised in stating that the balance carried into the account had been increased by £4,830, which was practically the 2 per cent. dividend which it was recommended should be distributed to the ordinary shareholders. It was satisfactory to know that that increased balance was entirely due to lessened working expenses. In every direction economies had been effected; power, running and parcels had been reduced by £1,023; repairs and maintenance by £2,876; and administration and general by £1,236. Unfortunately, the traffic receipts showed a decrease of £400, even on the low figures recorded for 1908. That was a matter which it was difficult for the directors and staff to deal with, as it was largely caused by the serious trade depression which existed last year in the district, and over which they had no control. The parcels business formed quite a useful adjunct to their undertaking, and year by year showed a steady growth, despite the decreased trade of the district. The capital expenditure during the year amounted to £1,680. The greater portion had been spent on the doubling and improvements of the lines, and in addition £3,590 had been expended on permanent way renewals, which had been charged to renewals account. They anticipated last year an expenditure of £5,297, against which they proposed a provision of £2,000. As a matter of fact, they had spent £1,700 less than they estimated, and consequently the balance of that account was correspondingly better by that amount than they anticipated last year. They might rest assured that the considerable sum spent last year on the permanent way had been well spent, and because they spent less than their estimate, it did not mean that the permanent way repairs had been in any way skimped. On the contrary, he had pleasure in reading them an extract from the Board of Trade inspecting officer's report, which he made last December, after an inspection of the lines. That officer said:—

> In Burslem the track from the Market Place to the North Road has been put into thorough repair. The representatives of the borough had no complaints to make in regard to the track. In the borough of Stoke the line in Liverpool Road has been put in thorough repair. In Church Street the track has been relaid with heavy rails. In London Road half the track has been relaid with the end of the old rails cut off and part with new rails weighing 110 lb. to the yard. This part of the track is now in excellent condition. The borough authorities agree that the track is in much better condition than it was two years ago.

The underwriting figure in the balance-sheet—£5,302—remained the same as last year. That represented the cost of raising nearly three-quarters of a million of money, and he did not think it could be looked upon as other than an extremely moderate figure. Since the last meeting the federation of the towns of Hanley, Burslem, Stoke, Tunstall and Longton, had become an accomplished fact. As he had stated in 1908 when the federation was in contemplation, it was impossible to forecast how far, if at all, their company would be affected. It was satisfactory to know that the overdraft at the bank had been considerably decreased—from £15,561 to £7,130. On the other hand, creditors had increased by £4,900, which represented an advance from the British Electrical Federation. They had instituted the "fair fare" system, following the example of the other federated companies, but it had not been in existence for a sufficient length of time for them to test its increased earning capability, but they hoped it would result in increasing their revenue.

SIR T. PILKINGTON, Bart., seconded the motion, and the report was adopted.

Kalgoorlie Electric Power and Lighting Corporation, Ltd.—The report states that, owing to the destruction by fire of the greater part of the machinery of the Great Boulder Perseverance Gold Mining Co. (one of the corporation's largest consumers), the demand for power was not so large as in the previous year, and the increased cost of fuel and water, also a reduction in the maximum price received for power, together with the extra expense incurred in handling the firewood in consequence of wood strikes, considerably reduced the profits of the year's trading to December 31st. The preference dividend has been paid, and a further £4,000 placed to reserve for depreciation and renewals, bringing up the total amount under this heading to £19,000. In view of the larger amount of power required by the Great Boulder Perseverance Co. for their new plant, it has become necessary to install another unit of plant. The orders for this have been placed. To provide for the cost, to discharge the bank overdrafts, and to put the corporation's finances on a sound commercial basis, a further part of the £60,000 6 per cent. first mortgage debentures created has been been sold, making the total amount placed £56,600. The annual meeting was held yesterday.

Continental.—The *Financial News* Brussels correspondent states that a joint-stock company was to be constituted there, with the object of supplying electric power and light to the City of Rosario. The capital of the new venture is given as 17,500,00 *fr.*, in which the Tramways Co. of Rosario will be interested to the amount of 4,000,000 *fr.* "This latter concern will in future get its supply of electric current from the new company."

FRANCE.—La Compagnie Electrique du Secteur de la Rive Gauche de Paris reports a profit of £36,314 for the last financial year, as compared with only £15,318 in the previous 12 months.

The balance-sheet of the Société Electro-Metallurgique de Dives for the last financial year shows a profit of £48,777, as contrasted with £60,745 in the preceding 12 months.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Inc
Aberdeen	May 25	2,790	+ 160	51	69,083	— 557	..	..
Ayr	,, 28	548	+ 46	..	..	..	8	..
Bath	,, 14	1,458	— 91	19	18,410	+ 1,146	..	..
Belfast	,, 27	8,871	+ 621	8	31,927	+ 597	37	..
Birkenhead	,, 29	2,243	— 245	8	8,880	— 75	13·63	..
Birmingham Corp.	,, 21	14,418	+1,555	7	49,632	+ 621	56	..
Blackburn	,, 25	2,624	+ 460	8⅔	9,637	— 509	14·12	..
Blackpool Corp.	,, 26	3,658	+2,343	..	6,707	+ 194	..	..
Blackpool-Fleetw'd	,, 28	2,102	+1,256	21	8,270	+ 1,123	..	..
Bolton	,, 22	5,200	+ 471	8	17,378	— 2,849	26	..
†Bournemouth	,, 18	2,142	+ 644	6⅔	11,286	— 604	21·96	..
Bradford	,, 21	11,465	+1,949	8	36,852	+ 445	54·81	..
Brighton	,, 29	2,168	+ 299	8⅔	7,545	— 341	9·5	..
Bristol	,, 27	14,096	+3,165	21	15,842	+ 1,532	..	..
Brit. Elec. Trac. Co.								
Airdrie	,, 20	462	+ 5	20	4,340	+ 98	3·65	..
Barnsley	,, 20	874	+ 39	,,	3,444	+ 168	..	..
Barrow	,, 20	617	+ 192	,,	4,721	+ 603	5·37	..
Cavehill	,, 20	230	+ 24	,,	1,539	+ 166	..	..
Devonport	,, 20	888	+ 179	,,	8,153	+ 921	8·85	..
Gateshead	,, 20	2,000	+ 45	,,	19,114	— 222	11·25	..
Gravesend	,, 20	475	— 82	,,	3,857	+ 189	6·5	..
Greenock	,, 20	1,397	+ 200	,,	11,316	+ 1,507	7·25	..
Hartlepool	,, 20	529	+ 86	,,	4,215	+ 254	6·72	..
Kidderminster	,, 20	324	+ 135	,,	2,988	+ 160	..	..
Leamington	,, 20	391	+ 60	,,	2,962	..	..	..
Merthyr	,, 20	504	+ 89	,,	3,926	— 127	2·9	..
Metropolitan	,, 20	18,200	+5,757	,,	140,791	+28,444	22	..
Middleton	,, 20	709	— 15	,,	5,721	— 464	8·5	..
Mid. Joint Com'tee	,, 20	11,074	+ 163	,,	111,773	+ 4,465	..	..
Oldham—Ashton	,, 20	1,196	+ 68	,,	10,669	— 55	9·13	..
Peterborough	,, 20	302	+ 85	,,	2,093	+ 49	5·81	..
Potteries	,, 20	3,758	+ 149	,,	34,683	— 21	29	..
Rothesay	,, 20	254	— 50	,,	1,685	— 70	2·75	..
Southport	,, 20	777	+ 205	,,	5,132	+ 310	8·17	..
S. Metropolitan	,, 20	2,172	+ 508	,,	15,298	+ 1,219	..	..
Swansea	,, 20	2,471	+ 624	,,	20,165	+ 2,557	12·5	..
Tynemouth	,, 20	616	+ 241	,,	3,412	+ 477	3·75	..
Weston-s-Mare	,, 20	409	+ 198	,,	1,200	+ 168	3	..
‡Worcester	,, 20	673	+ 138	,,	5,061	+ 191	5·75	..
Wrexham	,, 20	228	+ 41	,,	1,897	+ 50	..	..
Yorks. Wool. Dist.	,, 20	2,251	+ 426	,,	19,156	+ 2,113	17	..
Miscellaneous	,, 20	473	+ 2	,,	3,955	+ 266	..	..
Burnley	,, 28	2,775	+ 290	..	..	..	..	..
Burton-on-Trent	,, 29	559	+ 31	8	2,203	— 10	6·62	..
Bury	,, 29	2,749	+ 434	8⅞	9,875	— 462	22·5	..
Cardiff	,, 21	4,743	+ 597	8	15,873	— 115	..	..
†Carlisle	,, 12	155	+ 15	10	1,491	+ 45	..	..
Chatham and Dist.	,, 19	1,880	+ 290	20	15,507	+ 814	14·98	..
Cork	,, 26	1,169	+ 357	21	9,542	+ 1,603	9·89	..
Croydon	,, 20	3,100	+ 194	..	9,593	+ 140	11·25	..
Darlington	,, 14	341	+ 33	7	1,806	+ 31	..	..
Darwen	,, 20	537	+ 42	7	1,708	— 152	4·86	..
†Dover	,, 21	270	+ 70	7	1,427	— 13	4·75	..
Dublin	,, 27	12,440	+1,484	..	103,324	+ 4,556	54·25	..
Dundee	,, 25	1,966	+ 84	..	..	..	15·5	..
East Ham	,, 21	2,341	+ 331	7⅞	7,532	+ 189	8·52	·77
Exeter	,, 27	731	— 140	8	2,534	— 344	5·5	..
Glasgow	,, 28	38,802	+2,186	..	886,940	+ 6,010	97·25	..
Hastings	,, 26	2,389	+ 538	..	..	..	..	..
Huddersfield	,, 28	3,828	+ 591	8	14,508	+ 846	28·5	·5
Hull	,, 28	5,552	+ 659	8	22,052	+ 1,091	14·5	1·5
Ilkeston	,, 26	304	— 50	8	997	— 39	..	..
Ipswich	,, 21	928	+ 223	7	2,793	+ 126	10·5	..
Kilmarnock	,, 21	350	+ 10	..	..	..	4·25	..
Lancashire United	,, 25	3,262	+ 679	..	26,458	+ 463	39	..
Leeds	,, 21	15,208	+1,384	7	51,176	+ 3,016	..	..
Leicester	.. ..	..	..	..	..	..	..	..
Leith	,, 28	1,256	+ 54	..	..	..	9	2
†Liverpool	,, 14	10,879	+ 248	19½	204,277	+ 4,950	113·5	6
††L.C.C.	,, 7	40,802	+5,407	..	213,703	+23,837	132½	9·25
London United	,, 28	17,508	+3,811	..	125,427	+10,216	..	..
Lowestoft	.. ..	..	..	..	..	..	..	..
Manchester	,, 21	32,390	+2,766	7	110,446	+ 1,302	183	1
Newcastle	,, 21	7,769	+ 278	..	27,609	— 1,452	14·5	..
Newport	,, 28	1,567	+ 262	9	6,103	+ 274	14·5	..
Oldham	,, 22	3,866	+ 163	8	15,518	— 1,009	23·75	..
Pontypridd	.. ..	..	..	..	..	..	..	..
Portsmouth	,, 21	4,187	+ 468	7	13,687	+ 900	14·5	·75
Preston	,, 25	1,714	+ 198	8	5,808	— 68	..	..
Rotherham	,, 3	1,060	— 25	44	26,087	— 992	12	2
Salford	,, 9	8,998	— 139	5⅞	24,551	— 1,115	..	..
Sheffield	,, 25	12,687	+1,600	8⅔	49,909	+ 3,510	39·8	2·05
Southampton	,, 25	2,617	+ 597	8	8,437	+ 449	..	..
Southend-on-Sea	,, 25	1,810	+ 485	8	3,831	+ 873	..	..
South Shields	,, 21	1,178	+ 189	7⅞	3,862	— 27	..	..
Swindon	,, 25	322	+ 66	..	..	..	..	..
Tyneside	,, 25	1,005	+ 177	21	8,224	— 180	..	..
Wallasey	,, 28	2,075	+ 245	8½	7,459	— 349	..	..
Walthamstow	,, 28	1,941	+ 240	8	5,909	+ 401	9	..
West Ham	,, 19	5,881	+ 851	7	16,905	+ 486	15·25	..
Wolverhampton	,, 25	2,174	+ 660	8	7,254	+ 944	14·25	1·75
Baker St.-Waterloo	,, 28	7,025	+ 625	21	72,135	+ 2,015	4·25	..
Cen. London Rly.	,, 28	12,785	+1,346	21	117,913	+ 2,220	6·82	..
Char., +, Sus. Hamp.	,, 28	3,660	+ 615	21	31,155	+ 180	7·75	..
City & S. Lon. Rly.	,, 29	3,020	— 125	21	28,321	— 157	7·26	..
Dublin-Lucan Rly.	,, 27	358	+ 75	21	2,593	+ 92	7	..
G.N., and City Rly.	,, 28	2,651	— 88	21	21,928	— 442	3·5	..
G.N., P'p. & Brmtn.	,, 28	12,608	+1,245	21	127,455	+ 5,905	9·25	..
†L'pool Overh'd Rly.	,, 22	3,097	+ 513	..	27,985	+ 735	6·2	4·2
†Llandudno-Col. Bay	,, 20	440	+ 253	24½	3,513	+ 554	..	..
Mersey Railway	,, 28	4,082	+ 160	21	42,474	+ 1,099	4·5	..
Metropolitan Rly.	,, 29	85,886	+2,019	..	847,407	+12,597	24·5	..
Met. District Rly.	,, 28	28,258	+2,983	21	229,021	+22,977	24	..
Anglo-Argentine	,, 27	95,081	+16,710	..	927,883	+99,916	..	..
‖Auckland	May	14,848	+1,715	20	73,929	+ 5,041	23·98	·48
Bombay (B.E.T.)	April 26	5,676	+ 533	17	46,973	+ 3,263	..	..
‖Brisbane	April	17,690	+2,160	..	..	..	..	..
‖Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	April 28	6,572	+ 193	..	..	..	..	..
‖CapeElectricT.Ld.	..	..	..	..	..	..	..	..
‖Kalgoorlie, W.A.	April	3,425	..	..	13,465	..	20·5	..
Madras	May 16	1,399	+ 183	..	12,402	+ 7,330	..	..
‖Lisbon	..	..	..	..	..	..	..	..
†Perth (W.A.)	,, 27	3,021	+ 298	..	32,989	+ 2,492	29	1

* Compared with the corresponding period of 1909. † One week only.
‡ Includes horse, steam and other receipts. ‖ One month.

STOCKS AND SHARES.

Tuesday Evening.

THERE is not a great deal doing in the Stock Exchange markets, and the activity which comes is more or less spasmodic. Anomalously enough, the prospects of an early decline in the Bank Rate are accompanied by stiff charges for money in the meantime; yet again, this is a factor which has no influence upon a flood of new issues. These invitations to subscribe come at a pace which makes a man wonder where all the money is expected to come from by way of response.

Once more, the principal feature amongst the electrical sections is the rapidity of movement in Anglo-American Telegraph Deferred stock. The price touched 28, as against 21 a fortnight ago, and within the past few days it has varied 2½ points between highest and lowest.

The denial by the chairman of the Mackay Companies—the corporation which holds the Ordinary stock of the Commercial Cable Company—that any agreement had been made, or was in contemplation between the Commercial Cable or the Anglo-American Telegraph Companies, met with incredulity in the market. On the day that the denial appeared, Anglo "A" rose about a point by way of comment upon the statement. A denial in somewhat similar terms, but in relation to a company other than the Anglo-American, was recalled, and in some quarters the Mackay declaration was regarded as turning possibility into rather more than probability.

Mackay Common has gained 2 points, while Direct United States shares rose 10s. upon a few buyers realising that they had been strangely overlooked. Anglo "A" is up 2½, and the 6 per cent. Preferred gained 3 points, rising to 105, while the Ordinary rose 3. To those who bought the Preferred at a considerably lower price when it was indicated, on several occasions, as a good 6 per cent. speculative investment, the further counsel may be tendered that it will be well to hold the stock for a still higher value.

The rest of the Telegraph market is dull and listless. Globe Telegraph and Trust, of both kinds, are easier. West Coast of America lost $\frac{1}{16}$; so have West India and Panama Ordinary shares. Reuter's are *ex* the dividend of 4s., and are marked down ⅛. A rise of ½ in National Telephone Preferred is the only alteration amongst telephone issues.

Summer dulness deepens over the catalogue of electricity supply shares. Falls of ⅛ or ¼ have taken place in the Ordinary shares of the Kensington, Metropolitan, St. James', South London and Newcastle-on-Tyne Companies. Westminster Ordinary are ¼ better, regaining half their decline of last week. It is a little singular that St. James' Preference should be ⅛ up, the Ordinary having fallen. County of London First Debenture stock rose 2 points.

In the foreign group, Mexican Light and Power Common shares lost 1, while Mexican Electric Light 5 per cent. mortgage bonds improved to 85. Mexico Tramway shares drooped, but the 5 per bonds at 97 are ½ better, and a fair amount of business is being done in the company's 6 per cent. fifty-year mortgage bonds, the price being about 100½, with coupons due July 1st and January 1st. Rio Trams are steady at 97½, and Sao Paulos keep about 150.

The Home Railway boomlet is distinctly intermittent. It lacks sufficient business to keep it going for any length of time, and as soon as the buyers are satisfied, away sag prices again. Metropolitan Consolidated and Districts were both affected by an outbreak of weakness amongst steam stocks at the beginning of the week, and the prices are materially lower. Central Londons have managed to hold their own, but City and South London fell ½ in sympathy with the prevailing sentiment. East London at 3⅞ is ½ lower. The 4 per cent. Debenture stocks of the three Tube railways which are virtually one—the Piccadilly, Charing Cross and Bakerloo—are all quoted at 96 to 98, and the rises registered last week in the Underground Electric Railway have been fully maintained.

In other transportation descriptions there are no outstanding features. British Electric Tractions, Ordinary and Preference, have lost 2s. 6d. Anglo-Argentine Trams Second Preference moved up slightly after their sharp drop; but the First Preference have not rallied. British Columbia 5 per cent. Preference is a point higher. Industrials are almost as quiet. Callenders are 10s. down, which is the amount of the dividend, the price being now *ex*, and a decline of $\frac{1}{16}$ in Castner-Kellners is accounted for by a similar reason. Babcock Ordinary went back $\frac{1}{16}$, but a smart rise took Dick, Kerrs to 1½ middle.

Doulton & Co., Ltd.—The directors' report for 1909 states that after providing for debenture interest and writing £500 off goodwill, there is a debit balance of £16,010.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1906.	1907.	1908.	1909.	Closing Quotations May 24th.	Closing Quotations May 31st.	Business done week ended May 31st. 1910. Highest	Lowest	Rise + or Fall —	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	£8	Nil	Nil	Nil	Nil	8⅜ — 8⅞	8⅜ — 8⅞	..	..	..	Nil.
116,200	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	100 —102	100 —102	..	..	..	4 18 0
$255,196,000	American Telephone & Telegraph, Cap. Stock ..	$100	8 %	8 %	8 %	8 %	140 —142	140 —142	..	..	..	5 12 8
$68,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	93 — 95	93 — 95	..	..	..	4 4 3
558,460	Anglo-American Telegraph	Stock	3½%	3½%	£3 4s.	3½%	61 — 63	64 — 66	65	..	+3	6 9 6
3,220,770	Do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	101½ —102½	104 —105	106½	102½	+3½	5 13 2
3,220,770	Do. do. Deferred	Stock	1½%	1 %	8/-	26/-	24⅜ — 24⅝	26⅜ — 26⅞	28 3/8	24 15/16	+2½	4 13 6
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	100 —102	100 —102	..	..	..	4 18 0
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	..	7⅛ — 7⅜	7⅛ — 8 1/16	7⅛	..	..	4 16 6
2,449,176	Commercial Cable, Sting. 500 year 4% Deb. Stk. Red.	Stock	4 %	4 %	4 %	4 %	85 — 87	85 — 87	86⅜	85⅜	..	4 12 0
15,000	Cuba Telegraph	10	6 %	6 %	6 %	6 %	8½ — 9	8½ — 9	..	..	..	6 13 4
5,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	16⅝ — 17½	16⅝ — 17½	..	..	..	5 17 8
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	..	8⅜ — 8⅝	8⅜ — 8⅝	..	..	..	6 3 3
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	7⅞ — 8¼	7⅞ — 8¼	..	..	..	6 1 3
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 8
60,710	Direct United States Cable	20	4½%	4½%	4½%	4 %	13⅛ — 13⅜	14 — 14½	14⅛	13 7/8	+ 1/8	5 10 4
39,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	100 —102½	100 —102	..	..	..	4 8 8
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	..	133 —136	133 —136	135	133	..	5 2 11
2,000,000	Do. 3½ % Pref. Stock..	100	3½%	3½%	3½%	3½%	85 — 87 xd	85 — 87	85½	..	..	4 0 6
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	101 —103 xd	101 — 103	..	..	..	3 17 8
800,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	7 %	12⅜ — 13½	12⅜ — 13½	13	12⅜	..	5 5 8
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 17 8
230,000‡	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	99½ —101½	99½ —101½	..	..	..	3 18 10
181,127	Globe Telegraph and Trust	10	5½%	5½%	5½%	..	10½ — 11	10⅜ — 10⅞	10⅜	10 1/8	— ⅛	5 5 9
181,127	Do. do. 6 % Pref...	10	6 %	6 %	6 %	6 %	13⅛ — 13⅜	13 — 13½	13⅜	13¼	— ⅛	4 8 11
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	20 %	20 %	18 %	..	30½ — 31½	30½ — 31½	30½	..	..	5 16 8
,000	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 8
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	13 %	52½ — 54½	52½ — 54½	54½	..	..	6 16 0
$41,880,400	Mackay Companies Common	$100	3½%	4 %	4 %	4½%	86 — 91	90 — 93	..	..	+3	4 11 5
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	77 — 80	77 — 80	..	..	..	5 0 0
894,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	1/8 — 1/4	1/8 — 1/4	14/9	13/3	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	6 %	6 %	6 %	6 %	7/8 — 1	7/8 — 1	18/-	..	..	6 0 0
86,492	Do. do. do. 5 % Pref.	1	5 %	5 %	5 %	5 %	7/8 — 1	7/8 — 1	..	..	..	5 6 8
2,295,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	104 —105½	104½ —106	105½	104½	+ ½	5 13 2
8,725,000	Do. do. Def. Stock	100	5 %	6 %	6 %	6 %	124 —126	124 —126	124½	124½	..	4 15 3
15,000	Do. do. 5 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10 — 10⅜	10 — 10⅜	..	..	..	5 11 8
15,000	Do. do. 5 % Cum. 2nd Pref. ..	10	5 %	6 %	6 %	6 %	10 — 10⅜	10 — 10⅜	..	..	..	5 11 8
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5¼ — 5⅜	5¼ — 5⅜	5⅜	5¼	..	4 10 11
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	97 — 99	97 — 99	97½	..	..	3 11 8
1,988,598	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	100½	..	..	3 18 5
179,318	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	8 %	8 %	8 %	1 1/16 — 1 1/8	1 1/16 — 1 1/8	29/4½	25/-	..	4 14 10
50,000	Do. do. do. 6 % Cum. Pref... ..	1	6 %	6 %	6 %	6 %	1 1/16 — 1 1/8	1 1/16 — 1 1/8	23/9	..	..	4 14 9
195,955	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	87 — 89	87 — 89	..	..	..	4 9 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	98½ —100⅛	98½ —100⅛	..	..	..	3 18 10
11,889	Reuter's	8	5 %	5 %	5 %	5 %	7⅞ — 8	7⅞ — 8 xd	7⅞	7⅞	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	100½ —102½	100½ —102½	..	..	..	4 7 10
3,042	Submarine Cables Trust	Certs.	6 %	6 %	6 %	..	128 —131	128 —131	..	..	..	4 11 7
120,000	United River Plate Telephone..	5	8 %	8 %	8 %	..	7⅛ — 7⅜	7⅛ — 7⅜	7⅛	..	..	5 8 6
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5¼ — 5½	5¼ — 5½	..	..	..	4 10 11
80,008	W. Coast of America, 1 to 80,000 & 58,001 to 63,008	2½	2½%	2½%	2½%	..	1 1/2 — 1 5/8 xd	1 1/16 — 1 1/8	..	..	— 1/16	4 6 11
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	98½ -100½	98½ -100½	..	..	..	3 19 7
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980.. ..	10	7 %	7 %	7 %	..	13½ — 14¼	13⅜ — 14¼	14 1/16	13⅜	..	4 18 3
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	101 —10b	101 —103	..	..	..	3 18 3
88,821	West India and Panama Telegraph	10	Nil	Nil	Nil	..	3/8 — 7/16	1 3/16 — 1 3/8	14/-	13/9	— 1/16	Nil
34,568	Do. do. 6 % Cum. 1st Pref.	10	8 %	6 %	6 %	..	8⅜ — 9⅛ xd	8⅜ — 9⅛	8¼	..	..	6 9 9
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	£2 6	15 %	..	8 — 9	8 — 9	..	..	..	16 12 9
80,000‡	Do. do. 5 % Debs., Nos. 1 to 1 800 ..	100	5 %	5 %	5 %	5 %	101 —103	101 —103	..	..	..	4 17 1

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5 % Cum. 1s Pref., 1 to 640,000	5	..	..	..	5 %	4½ — 4⅝	4½ — 4⅝	93/9	90/7½	..	5 5 8
500,000	Do. 5 % 2nd Pref., 800, to 1,300,000	5	..	..	..	5 %	4 7/8 — 4 15/16	4¾ — 4⅞	88/1½	85/-	+ 1/16	5 11 1
4,465,674	Do. 4 % Deb. Stock	Stock	..	..	4 %	4 %	90½ — 92	90½ — 92	91½	90½	..	4 7 0
882,387	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	105 —107	105 —107	..	..	..	4 13 6
580,000	Babcock & Wilcox, 1 to 580,000	1	20 %	20 %	20 %	24 %	5⅜ — 5	5 3/16 — 5 5/16	5¼	5 5/32	..	4 9 6
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1 1/16 — 1 1/8 xd	1 1/16 — 1 1/8	..	..	..	3 19 2
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	Nil	..	..	..	..	..	..	Nil
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	3½%	..	..	..	..	..	..	..
40,100	Do. do. "A" 5 % Cum. Pref. ..	5	5 %	5 %	5 %	..	..	..	..	..	..	..
12,897	Do. do. 4 % Funding Certs. ..	5	4 %	4 %	2 %	..	..	..	..	..	..	..
124,400	Do. do. 5½ % Loch Leven Debs.	100	5½%	5½%	5½%	5½%	97 —100	97 —100	..	..	..	5 10 0
500,000	British Columbia E. Rail Def. Ord. Stock ..	100	8 %	8 %	8 %	8 %	142 —147	142 —147	145	..	..	5 8 7
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	6 %	6 %	122 —126	122 —126	124¾	124½	..	4 15 3
400,000	Do. 5 % Cum. Perp. Pref. Stock ..	100	5 %	5 %	5 %	5 %	108 —111	109 —112	111	110½	+1	4 9 3
288,000	Do. 4½ % 1st Mort. Debs., 1 to 5,250	40	4½%	4½%	4½%	4½%	102 —104	102 —104	..	..	..	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,900	100	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 5 9
188,301	British Electric Traction	10	Nil	Nil	Nil	..	1/4 — 1/2	3/4 — 1½	17/6	..	— ¼	Nil
161,437	Do. do. 6 % Cum. Pref.	10	6 %	3 %	1½%	..	3½ — 3⅝	3⅜ — 3⅝	67/6	62/6	— ⅜	4 2 9
1,478,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	..	90 — 93	90 — 93	94	91½	..	5 7 6
628,986	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	..	66 — 71	66 — 71	67½	..	..	6 6 9
100,000	British Insulated and Helsby Cables	5	10 %	10 %	10 %	10 %	6½ — 7	6½ — 7	..	..	..	7 2 10
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6¼ — 6½	6¼ — 6½	..	..	..	4 16 0
600,000	Do. do. 4½ % 1st Mort. Deb. Red. ..	100	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..	4 4 11
204,940‡	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 75,000	5	Nil	Nil	Nil	..	3/8 — 7/16	3/8 — 7/16	..	..	..	Nil
1,316,353	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	..	58 — 61	59 — 62	..	..	+1	6 9 1
[illegible]	Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	..	3/16 — 1/4	3/16 — 1/4	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,975	Brush Electrical Engineering, Ord., 1 to 105,781 ..	2	Nil	Nil	Nil	..	0 — 1/8	0 — 1/8	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	Nil	Nil	Nil	..	0 — 1/8	0 — 1/8	..	..	..	Nil
125,000‡	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	39 — 44	39 — 44	..	..	..	10 4 6
125,000‡	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	25 — 29	25 — 29	..	..	..	15 8 0
137,610	Calcutta Trams, 1 to 137,610	5	8 %	6 %	4½%	4½%	4¼ — 4⅜	4¼ — 4⅜	87/6	..	..	4 14 9
45,804	Do. 5 % Cum. Pref., Nos. 1 to 29,980..	5	5 %	5 %	5 %	5 %	4¾ — 5	4¾ — 5	..	..	..	5 0 0
860,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
35,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	10 %	9½ — 10⅜	9½ — 10⅛ xd	9 1/8	9⅞	..	4 17 7
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5⅝ — 5⅞	5 — 1/8	5⅛	5	— ⅛	4 13 0
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	102½ —104½	102½ —104½	..	..	..	4 6 2
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	..	1/4 — 3/8	1/4 — 3/8	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	8 %	12 %	12½%	12½%	2⅞ — 2 15/16	2 15/16 — 2 17/32 xd	5 /9	..	..	4 7 9
210,158	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4 %	4½%	104 —107	104 —107	..	..	..	4 4 1
1,890 690	Central London Railway, Ord. Stock	Stock	4 %	3 %	3½%	3 %	71 — 73	71 — 73	71½	71½	..	4 3 2
564,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	86 — 88	86 — 89	88½	..	..	4 10 11
564,655	Do. do. Def. do.	Stock	4 %	2 %	2½%	2 %	53 — 55	53 — 55	..	..	..	3 12 9
1,480,000	City and South London Railway	Stock	2½%	2½%	1½%	1½%	83½ — 84½	83 — 84	..	..	— ½	5 2 11
85,000	Crompton & Co., Nos. 1 to 85,000	£	5 %	5 %	Nil	..	3/8 — 7/16	3/8 — 7/16	..	..	..	Nil
100,000‡	Do. 5 % 1st Mort. Reg. Debs., 1 900 of £100, and 901 11,000 of £50 Red	..	5 %	5 %	5 %	5 %	88 — 91	88 — 91	..	..	..	5 9 11

* Unless otherwise stated, all shares are fully paid. ‡ From Manchester Share List.

Continued on next pag

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations May 24th.	Closing Quotations May 31st.	Business done week ended May 31st, 1910.		Rise + or Fall —	Present Yield per cent.
		*	1906.	1907.	1908.	1909			Highest	Lowest.		£ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	6 %	..	⅞ — 1	1 1/16 — 1 1/16	..	..	+ 1/16	5 1 1
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000 ..	1	6 %	6 %	6 %	6 %	1 — 1⅛	1 — 1⅛	21/3	..	..	5 6 8
271,080	Do. do. 4½ % Deb. Stock	100	4½ %	4½ %	4½ %	4½ %	99 —102	99 —102	..	..	..	4 8 3
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	13 — 14	13 — 14	..	..	..	4 7 8
99,251	Edison & Swan Utd., "A" shs., £8 pd., 1 to 99,251	5	4½ %	2½ %	Nil	..	1/16 — 1/16	1/16 — 1/16	..	..	..	Nil
17,189	Do. "A" shares, 01—017,189 ..	5	4½ %	2½ %	Nil	..	1 — 1⅛	1 — 1⅛	..	..	..	Nil
307,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	65 — 70	65 — 70	66½	..	..	5 14 4
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	79 — 82	79 — 82	..	..	..	6 1 11
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	..	½ — ⅝	½ — ⅝	..	..	..	Nil
81,890	Do. do. 7 % Cum. Pref., 1 to 81,890..	2	7 %	7 %	7 %	7 %	1 1/16 — 1 1/16	1 1/16 — 1 1/16	..	..	..	9 0 8
25,000	General Electric Co. (1900), 5 % Cum. Pref. ..	10	5 %	5 %	5 %	..	7 7/16 — 8 1/16	7 7/16 — 8 1/16	..	..	..	6 1 3
230,000	Do. do 4 % Mort Deb... ..	Stock	4 %	4 %	4 %	4 %	82 — 86	82 — 86	..	..	..	4 13 0
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	½ %	Nil	..	½ — 1	½ — 1	..	..	..	Nil
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	..	..	10 1/16 — 10 3/16	10 1/16 — 10 3/16	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	..	1 09/16 —109½	102 —109½	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15 %	15 %	15 %	15 %	11 7/16 — 12 5/16	11 7/16 — 12 5/16	12 1/16	11 7/16	..	5 18 9
40,000	Do. do. 4½ % Pref.	5	4½ %	4½ %	4½ %	4½ %	5 — 5⅛	5 — 5⅛	..	..	..	4 8 9
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½ %	4½ %	4½ %	4½ %	105½ —107½	103 —105 xd	..	..	..	4 8 9
50,000	India-Rubber, Gutta-percha & Telegraph Works..	10	10 %	10 %	10 %	10 %	14 3/16 — 15 3/16	14 3/16 — 15 3/16	..	..	..	6 10 1
87,500	†Liverpool Overhead Railway, Ord.	10	Nil	½ %	Nil	Nil	1 1/16 — 1 3/16	2 — 2	..	..	+ 1/16	Nil
10,000	† Do. do. Pref., fully paid ..	10	5 %	5 %	5 %	5 %	5 — 5½	5 1/16 — 5 3/16	..	..	+ 1/16	8 13 11
600,070	London United Trams. (1901), 1 to 50,007	10	3 %	3 %	Nil	..	1½ — 2½	1½ — 2½	..	..	..	Nil
899,980	Do. do. 60,008 to 100,000	10	3 %	3 %	Nil	..	1½ — 2½	1½ — 2½	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	3⅜ %	..	2½ — 2⅝	2½ — 2⅝	45/-	..	..	13 12 8
1,649,980	Do. do. 4 % 1st Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	68 — 72	68 — 72	69	..	..	5 11 1
5,782,062	Metropolitan Consolidated	100	1 %	½ %	½ %	1 %	44 — 44½	42½ — 43	44	42½	—1½	2 6 6
2,640,914	Do. Surplus Lands	100	2½ %	2½ %	2½ %	2½ %	66 — 68	66 — 68	..	..	..	4 0 11
6,285,000	Do. District	100	Nil	Nil	Nil	Nil	24 — 24½	23½ — 23⅝	24 3/16	24 1/16	— 1/16	Nil
891,887	Metropolitan Electric Trams., Ord.	1	..	..	4½ %	..	3⅛ — 3⅜	3⅛ — 3⅜	..	..	..	5 15 0
814,016	Do. do. Defd...	1	Nil	Nil	Nil	..	⅛ — ⅜	⅛ — ⅜	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref. ..	1	5 %	5 %	5 %	5 %	3 29/32 — 3 31/32	3 29/32 — 3 31/32	15/6	..	..	5 19 5
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½ %	4½ %	4½ %	4½ %	97 —100	97 —100	..	..	..	4 10 0
$10,823,200	Mexico Trams Co., Common Stock	..	..	..	..	..	130 —132	129½ —131½	130⅜	130	— ½	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	5 %	..	96 — 97	96½ — 97½	97½	96½	+ ½	5 2 7
245,500	Potteries Electric Traction	1	4 %	4 %	Nil	..	⅜ — ½	⅜ — ½ xd	..	..	..	..
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	1 — 2	1 — 2	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½ %	4½ %	4½ %	4½ %	82 — 85 xd	82 — 85	..	..	..	5 3 6
87,850	Telegraph Construction and Maintenance	12	15 %	17½ %	15 %	17½ %	32½ — 34½	32½ — 34½	34½	34	..	7 2 10
140,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	100½ —102½	100½ —102½	..	..	..	3 18 1
1,000,000	Underground Electric Railway, 5% Prior Lien ..	..	..	..	5 %	..	100½ —101½	100½ —102½	..	..	..	4 18 6
2,800,000	Do. do. 4½% Bonds	..	..	..	4½ %	4½ %	89 — 91	89 — 91	90⅞	..	..	4 18 11
4,900,000	Do. do. 6% Income Bonds	..	..	..	..	..	38 — 40	38 — 40	38½	..	..	..
66,666	Willans & Robinson, 1 to 80,000 & 80,001 to 116,666	1	Nil	10 %	5 %	Nil	½ — ¾	½ — ¾	..	..	— ⅛	..
66,666	Do. 6 % C.P., 80,001 to 80,000 & 125,001 to 141,666	5	..	6 %	6 %	3 %	1¾ — 2¼	1¾ — 2	..	..	— ¼	7 10 0
245,495	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	60 — 70	60 — 70 xd	..	..	..	5 14 4

ELECTRICITY SUPPLY COMPANIES.

80,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10%	10 %	10 %	10 %	7⅜ — 7⅞	7⅜ — 7⅞	..	..	..	6 10 1
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7 — 7½	7 — 7½	..	..	..	6 13 4
400,000	Central Electric Supply 4 % Guar. Deb. Stock ..	100	4 %	4 %	4 %	4 %	100 —103	98 —101 xd	..	..	..	3 19 3
80,000	Charing Cross and Strand Electricity Supply ..	5	5 %	5 %	5 %	5 %	3⅜ — 4⅛	3⅜ — 4⅛	79/11⅛	..	..	6 17 8
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½ %	4½ %	4½ %	4½ %	4⅜ — 4⅝	4⅜ — 4⅝	88/9	..	..	4 17 4
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½ %	4½ %	4½ %	4½ %	8⅜ — 4⅝	8⅜ — 4⅝	..	..	..	5 2 10
445,736	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	97 —100	97 —100	..	..	..	4 0 0
49,486	Chelsea Electricity Supply, Ord.	5	4½ %	4½ %	4½ %	4½ %	3⅝ — 4⅛	3⅝ — 4⅛	..	..	..	5 9 1
175,000	Do. do. 4½ % Deb. Stock Red. ..	Stock	4½ %	4½ %	4½ %	4½ %	101 —103	101 —103	102	..	..	4 7 5
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	7 %	11⅜ — 11⅞	11⅜ — 11⅞	11½	11 7/16	..	5 17 11
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	12 — 13	12 — 13	12⅜	..	..	4 12 4
400,000	Do. 5 % Db. Stk.	Stock	5 %	5 %	5 %	5 %	121 —125	121 —125	..	..	..	4 0 0
800,000	Do. 4½ % 2nd. Db. Stk.	100	4½ %	4½ %	4½ %	4½ %	100 —103	100 —103	102	..	..	4 7 5
50,000	County of Durham Electrical Power, Ord.	5	4 %	2 %	Nil	Nil	1½ — 2	1½ — 2	..	..	..	5 0 0
50,000	Do. do. do. 5 % Pref. ..	5	5 %	5 %	5 %	5 %	2⅜ — 3½	2⅜ — 3½	..	..	..	7 18 10
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	5 %	5 %	94 — 96	94 — 96	..	..	..	5 4 2
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7½ — 8	7½ — 8	7 7/8	..	..	6 5 0
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅝ — 11⅜	10⅝ — 11⅜	11¼	11 1/16	..	5 15 8
400,000	Do. do. 4½ % Deb. Stock ..	Stock	4½ %	4½ %	4½ %	4½ %	103 —106	105 —108	106½	106	+2	4 3 4
400,000	Do. do. 4½ % 2nd. Deb. Stock ..	Stock	4½ %	4½ %	4½ %	4½ %	98 —101	98 —101	100¼	98½	..	4 9 1
80,000	Edmundson's Electric Corporation, Ord. Shares ..	5	Nil	Nil	Nil	..	1/16 — ⅛	1/16 — ⅛	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	3 %	Nil	Nil	..	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	Nil
480,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½ %	4½ %	4½ %	..	7¼ — 76	74 — 77	..	..	+ ½	5 16 11
$8,150,000	Electrical Dev.Co.of Ontario, 6% 1stMtg.Gold Bnds.	$500	..	..	5 %	5 %	82 — 85	82½ — 85½	84¼	83½	+ ½	5 17 0
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4½ — 4⅝	4½ — 4⅝	..	..	..	6 15 9
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	5 — 5⅛	5 — 5⅛	5⅛	..	..	4 10 11
90,000	Do. 4½ % 1st Deb. Stock	100	4½ %	4½ %	4½ %	4½ %	101 —104	101 —104	..	..	..	4 6 7
15,000	Hove, 1 to 15,000	5	9 %	8½ %	8½ %	8½ %	7 — 7½	7 — 7½	..	..	..	5 13 4
$1,376,000	Kaministiquia Power Co., 5 % Gold Bnds.	100	..	..	5 %	5 %	102 —104	102 —104	..	..	..	4 16 2
21,000	Kensington and Knightsbridge Electric Ord. ..	5	10 %	10 %	8 %	8 %	7 — 7½	6⅞ — 7⅛	6 23/32	6⅞	+ ⅛	5 10 4
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	94½ — 96½	94½ — 96½	..	..	..	4 2 11
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	2½ %	3 %	..	1⅜ — 2	1⅜ — 2	..	..	..	4 8 11
70,000	Do. do. do 6 % Pref. ..	5	6 %	6 %	6 %	..	4⅜ — 5⅛	4⅜ — 5⅛	..	..	..	5 14 3
882,355	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4½ %	4½ %	4 %	4 %	92 — 94	92 — 94	..	..	..	4 5 1
300,000	Metropolitan Electric Supply, 1 to 100,000	5	8 %	6½ %	5 %	5 %	3⅜ — 4⅛	3¾ — 4	78/9	72/6	— ⅛	6 5 0
75,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½ %	4½ %	4½ %	4½ %	4⅛ — 4⅜	4⅛ — 4⅜	93/9	92/6	..	4 12 4
285,000	Do. 4½ % 1st Mort. Deben. Stock ..	Stock	4½ %	4½ %	4½ %	4½ %	104 —107	104 —107	..	..	..	4 4 1
248,000	Do. 3¾ % Mort. Deben. Stock Redem.	Stock	3¾ %	3¾ %	3¾ %	3¾ %	83 — 86	83 — 86	..	..	..	4 1 5
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	100	5 %	5 %	5 %	..	84½ — 85½	84½ — 85½	85⅜	84½	+ ½	5 17 0
18,585,000	Do. Light and Power Co., Ltd., Common ..	$100	..	..	3½ %	..	79 — 81	78 — 80	80	79½	—1	4 7 6
$2,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	7 %	7 %	103 —105	103 —105	104⅜	103½	..	6 13 4
12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	100	..	..	5 %	5 %	89½ — 90½	89½ — 90½	..	..	..	5 10 6
950,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	97 — 99	97 — 99	..	..	..	4 10 4
180,491	Newcastle-on-Tyne, 1 to 187,500	5	8 %	8 %	2½ %	..	4⅛ — 4⅜	4⅛ — 4⅜	..	..	—	2 14 0
187,500	Do. 5 % Pref., 1 to 187,500	5	5 %	5 %	5 %	5 %	4⅜ — 4⅞	4⅜ — 4⅞	..	..	..	5 2 7
125,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,255	100	..	..	..	5 %	99 —101	99 —101	..	..	..	4 19 0
10,853	Notting Hill Electric Lighting	10	7½%	7½%	7 %	..	11⅜ — 12½	11⅜ — 12½	..	..	..	5 9 10
20,000	Oxford, 1 to 96 and 407 to 20,319	5	7 %	7 %	7 %	7 %	6⅛ — 7	6⅛ — 7	..	..	..	5 0 0
119,894	River Plate Elcty. Co. Ord. Nos. 1 to 120,507	1	2½%	6 %	8 %	9 %	2 1/16 — 2 3/16	2 1/16 — 2 3/16	45/-	..	..	3 17 10
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	1	6 %	6 %	6 %	6 %	1 15/16 — 1 31/32	1 15/16 — 1 31/32	..	..	..	5 4 4
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	103 —105	103 —105	..	..	..	4 15 3
40,000	St. James' and Pall Mall Electric Light, Ord.	5	10 %	10 %	10 %	10 %	8¾ — 9	8¾ — 8⅞	..	..	— ⅛	5 14 3
80,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	6⅞ — 7⅛	6⅞ — 7⅛	7 1/16	..	+ ⅛	4 14 11
150,000	Do. do. 3¾ % Deb. Stock Red. ..	100	3¾%	3¾%	3¾%	3¾%	86 — 88	86 — 88	..	..	..	3 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	Nil	Nil	Nil	..	1⅜ — 2	1½ — 2	..	..	— ⅛	Nil
66,000	South London Electric Supply, Ord.	4	8 %	4 %	5 %	5 %	2⅞ — 3⅛	2⅞ — 3⅛	61/3	..	..	6 9 0
180,100	Do. do. 5 % 1st Mort. Deb.	100	..	..	5 %	5 %	101 —104	101 —104	..	..	..	3 16 11
120,000	South Mos. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	..	⅜ — ½	⅜ — ½	..	..	..	5 0 0
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 — 1⅛	1 — 1⅛	..	..	..	6 4 5
224,550	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	..	¾ — 1	¾ — 1	..	..	..	10 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	2 — 2½	2 — 2½	..	..	..	10 0 0
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	79 — 81	79 — 81	..	..	..	5 11 1
908,000	Victoria Falls Power Co., Pref. Nos. 1 to 908,000 ..	1	..	..	..	..	13/16 — 15/16	¾ — ⅞	..	..	— 1/16	5 14 3
100,00	Westminster Electric Supply, Ord.	5	12½	10 %	10 %	10 %	7⅛ — 8⅛	8 — 8⅜	8⅛	..	+ ½	5 17 8
51,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	4½%	4½%	4½%	4½%	5 — 5½	5 — 5½	5⅛	..	..	4 1 10

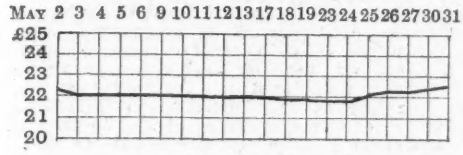
* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange.

Bank rate of Discount 4 per cent., March 17th, 1910.

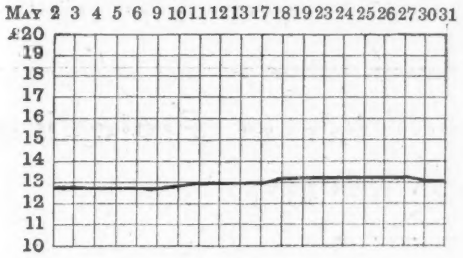
METAL MARKET.

Fluctuations in May.

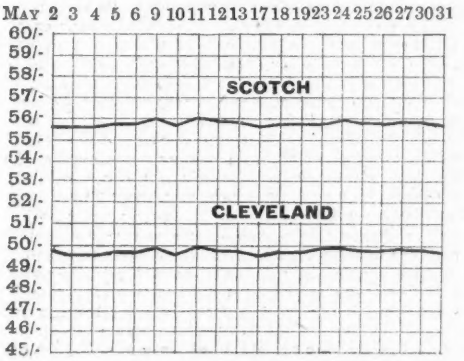
SPELTER (G.O.B's.).



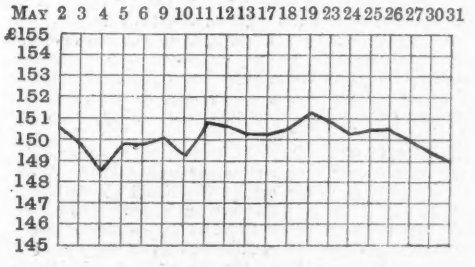
LEAD (ENGLISH).



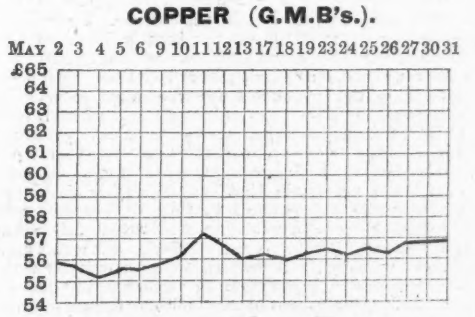
IRON.



TIN.



COPPER (G.M.B's.).



Ambulance Class Successes.—Twenty-eight members of the Aberdeen Corporation electricity staff have attended ambulance classes held by Dr. Thomas Fraser. At the examination under the St. Andrew's Ambulance Society, 26 passed and secured certificates.

ELECTRICITY IN SOME WELL-KNOWN PRINTING WORKS.

Messrs. Richard Clay & Sons' New Works.

One of the oldest and best known printing firms in this country is Messrs. Richard Clay & Sons, who have offices both in London and the provinces. The number of periodicals printed in these offices is legion; perhaps those best known to the general public are the *Ladies' Pictorial* and the *Illustrated London News*.

As is generally known, the firm are building magnificent works on the South side of the Thames, adjoining the works of Messrs. Hudson & Kearns, and near the premises of Messrs. Clowes. Messrs. Burrup & Mathieson are almost within a stone's throw, so that this point will soon become quite a printing centre. The new works will, of course, be electrically equipped throughout, and contracts have already been placed with Mr. J. Stannah, for lifts; Morris & Bastert, for runways; Electromotors, Ltd., for motor equipments; and Pinching & Walton, for the lighting installation. The whole of this work will be carried out to the specifications of the firm's consulting engineer, Mr. Frank Broadbent, M.I.E.E. Current will be taken from the mains of the City of London Electric Light Co., and two distinct three-wire services at 215/430 volts will be brought to a central point in the basement. At this point two main switchboards will be erected, each capable of dealing with half the load, the two services being kept entirely distinct throughout the building.

Change-over switches will be provided so that in case of emergency the whole load can be transferred to one service.

The switchboards will be somewhat of a departure from stereotyped practice in that they will be absolutely ironclad, and everything will be accessible from the front, no space at the back being provided. As far as practicable the same feature will be embodied in the distribution boxes, and all the starting switch equipments.

Individual driving will be adopted throughout, even down to the smallest machines, as in a new works it hardly pays to put up shafting when electric driving is adopted.

For all printing machines the starting gear will be of the full automatic type, and for other machines of the semi-automatic type, *i.e.*, the operator only closes the main switch by hand, after which the starting switch does the rest. When completed, we believe this installation will be the most complete and up to date of its kind, and we hope to have an opportunity of describing it in detail.

Messrs. Odham's and Southwood, Smith's Offices.

Owing to skilful management and splendid organisation, the amalgamated press of Odham's, Ltd., and Southwood, Smith & Co., Ltd., have, during the last few years, leapt right into the front rank of London printing and publishing companies. When they moved from their three scattered works into their new commodious Long Acre premises a few years ago, the question arose as to what was to be done with the existing electrical equipments. Not that it was intended to give up electric driving, but coming from three different works the motors and switchgear were for different voltages, viz., 200, 400 and 530 volts, whereas the voltage in the new Long Acre works was to be 200. The problem was whether to scrap 26 motors, or rewind them, or what. Eventually a consulting expert was engaged, viz., Mr. Frank Broadbent, who has specialised in printing machine driving, and by entirely rearranging the motors, he was able to make use of them all without rewinding any of them. This was effected by altering the field connections and using the motors, which were of comparatively high speeds, for lower powers and speeds. The starting resistances, of course, had to be regraded. In all, the works are equipped with about 50 motors, ranging from 2 H.P. to 25 H.P., the latter driving the Foster rotary which prints *John Bull* and other weekly publications. Our contemporary *Electricity* is also printed at this office. A duplicate three-wire service is brought into the building from the mains of the Charing Cross Co., but the whole output is normally run from one set of mains, the duplicate service being for emergency purposes only. The voltage across the outers is 200 volts, at which pressure all the motors are supplied, whilst 100 volts is used for lighting. The lighting is a combination of enclosed arc and metal-filament lamps, the arcs being used for general illumination and the metal-filament for individual machines where required. This gives a pleasing and efficient combination, and it has been remarked that the warehouse floor is the best lighted warehouse in London.

Owing to the phenomenal success of *John Bull*, *The Throne*, *Lotinga's Weekly*, and other of the joint firms' productions, larger adjoining premises have recently been taken, and new machinery is being installed, including a fast-speed Hoe quad rotary to be driven by a Witton-James equipment. The extensions are being supervised by the firm's consulting engineer. We understand that, when completed, these offices will rank among the largest in London.

Messrs. Alabaster, Passmore & Sons' Offices.

Messrs. Alabaster, Passmore & Sons first came into prominence as the printers of Spurgeon's sermons, but have since specialised in the printing of catalogues and fashion plates, which they have raised to a fine art. The work they turn out in this direction, both in black and white and three-colour work, is unsurpassed. They were one of the first printing firms to realise the immense advantages of the electric drive, and the large sign

"electric printers" over their extensive premises in Whitecross Street, E.C., was fixed long before many of the leading offices had given electricity a passing thought. Upwards of 60 motors are installed here, employed principally for individual machine driving. The installation, as originally carried out by Messrs. Marryat & Place, was arranged for 110 volts, and electricity was generated in the basement by "Castle" two-pole dynamos driven by gas engines running on town's gas. A few years ago satisfactory terms of supply were made with the Charing Cross Co., and the installation was gradually changed over to 200 volts under the direction of Mr. Frank Broadbent, the firm's consulting engineer. With few exceptions the machines, both litho. and letterpress, are driven from the motors by spur-gearing. Like many other firms, whose work has increased beyond the capacity of their London office, Messrs. Alabaster, Passmore & Sons have found it necessary to extend into the country. We hope we are correct in attributing this increasing business to the economy and other advantages of electric driving. The country works are situated near Maidstone, and are laid out on an excellent plan, so that work can be turned out very expeditiously. Current is taken from the mains of the Maidstone Corporation's electricity works on the three-wire system, the pressure being 230 volts on each side of the system. With the exception of the very small machines, such as stitchers, each machine is equipped with its own motor. The motors are generally of the interpole type, mounted on special brackets attached to the machines, and geared direct to the driving shafts by spur-gearing. A feature of the installation is the entire absence of overhead shafting, the only shafts employed, viz., those for stitchers and monotype casters, being placed on or under the floor. The starting switchgear is of the automatic type, and each machine is provided with a shunt field regulator for a speed variation of about 50 per cent. The general arrangements are in fact very similar to those at the Co-operative Printing Society's Manchester offices, both installations being, of course, designed by the same consulting engineer. The motors were made by Messrs. Stevens, Ltd., of Maidstone, who carried out the whole contract under Mr. Broadbent's supervision.

Debate on the Effects of Free Trade or Protection upon the Electrical Industry.

(*Continued from page* 858)

THE CHAIRMAN (Mr. H. W. Butler): I am sure, after the very able way in which Mr. Kingsbury and Mr. Hirst have opened this discussion, there must be many of you who would like to take part in it, and, therefore, I will ask if you will kindly give your names to the stewards, so that we may be in a position to call upon you as occasion arises. I would remind all present that this is essentially a trade meeting, and, consequently, only those intimate with the electrical trades will be allowed to speak. Further, in order to prevent the discussion from running beyond the limits that we can allow, it has been decided to limit speakers to a maximum of 10 minutes, and that no speeches shall be commenced after 10.30. I would also ask you to remember that this is a meeting to consider the question from a business point of view, and it is requested that the political side should be avoided as far as possible.

MR. J. S. RAWORTH: Mr. Chairman and Gentlemen,—I have come to-night to speak to you on a subject which is very restricted in its scope—I have undertaken to speak on the side of Free Trade as applied to the electrical industry, and I am not going to run Free Trade down; I am going to back it up. I was born a Free Trader; I have been bred a Free Trader; I have been a Free Trader ever since, and I am afraid I am going to die by Free Trade. (Laughter.) Do you know Mr. Hirst took out of my mouth one of the arguments that I was going to put before you. I was brought up in Lancashire. I know the cotton trade almost as well as I know the electrical engineering trade, and I know exactly what their point of view is, and I know perfectly well why they do not want what is called Protection. They want Free Trade; but let me point out this to you, that no great nation ever got into a position which entirely overclouded all other nations in the way of trade and commerce and manufacture, without being protected in some manner or other. Now, we were protected in the first instance by our sea coast running all round this little island; secondly, by the fact that we had all the coal which was wanted; thirdly, that we had a 30-ft. seam in Staffordshire; next that we had the best climate for spinning cotton; and, lastly, in Lancashire we have got the best brains and the best trained operatives that have ever been produced by any country in the world. I say we were protected by our position, and I don't think Mr. Kingsbury takes any notice of that. He calls that Free Trade, and so do I up to a certain point, and if we had these conditions in the electrical industry, we should have little to complain about. I went into this business in the year 1878. From that time we had about four years Free Trade, and I was making money just about as fast as I could put it by at that time. Then some clever gentleman — I think it was Mr. Chamberlain—said: "Oh, these people are going to transform the world; we must set to work and protect the municipalities." Just fancy, protecting the municipalities! They said they wanted to protect the municipalities from the electrical engineer, and they did it under a Bill which was set forth as being specially brought forward to foster the electrical industry. We had about six years, during which we could not get sandwiches even, let alone a decent dinner. We had a period of five or six years when everything was perfectly stagnant, when we were trying to fight against gas at 2s. 6d. per 1,000 cb. ft., whilst our German friends were only fighting against 5s. per 1,000 cb. ft., and our French friends had gas at 7s. 6d. per 1,000 cb. ft. I do not know whether Mr. Kingsbury calls that Free Trade; I should have been perfectly content if we had had Free Trade. In those five years if we had had the Free Trade that Mr. Kingsbury talks about, we should have been in a position when we got the improved Electric Lighting Act in 1887 to have gone ahead and carried everything before us. I daresay you will say that a good deal of money was subscribed, and so it was; but a good deal was squandered—it changed from certain pockets into other pockets. I know of some of my friends in the City who put up funds amounting to something like a quarter of a million in order to deal seriously with the electric lighting problem in London, if they had got the opportunity. Happily they got the advice of an honest engineer—it was not myself (laughter)—and he was on the look-out continually for a really good job in London where that money could be expended, but eventually he had to tell them that they had better take their money back again, and the whole of that money was refunded to the original subscribers. There was a case, where, if we had had an opportunity of showing what we could do, that money would have been usefully and profitably employed, but because we had not got Free Trade the Germans were able to handicap us and get into the premier position. I can go a step further than that. We make tramways as well as electric lighting apparatus, and I daresay that most of you are aware that about 90 per cent. of the tramway machinery in this country has come from America. As a mere matter of manufacture, the Americans have been able to scoop practically the entire pool in the matter of manufacture, and when you come to the investment of money, none is being invested at this present moment—not a single penny in any tramway undertaking in England—and it is simply because we are labouring under that effete old Tramway Act of 1870, which was made just for the purpose of dealing with the old horse tramways. That old Act of 1870 was the very beginning of the persecution of this industry. (A voice, "Politics, Sir!") Not a bit of it; it is giving you the absolute facts of the case. The effect of that Act was that when a Corporation came to buy up tramways that were made under that Act, they had nothing to buy up but old rubbish, and they had to pay prices which nobody imagined at the time they would ever have to pay. We used to talk about scrap iron price—every investor thought it was, and the Corporations thought it was, but, curiously enough, it turned out not to be scrap iron price, but they had a very good price for the tramways which were turned over. My view about this case is this—that if you would leave us all to Free Trade, and give us the opportunity of dealing with the Corporations, or dealing with the local authorities and make our own terms to satisfy our customers, then if they came to us and said, "We should like to buy you out," we should say, "our price is so much, but if you try to interfere with the trade in this manner you are sure to bring about trouble—you are sure to produce exactly the results which you don't want." If you restrict the trade you make profits less, and you give the foreigner an opportunity of coming in. I am not going to traverse the whole ground that has been gone over by the openers. I have only tried to point out that Mr. Kingsbury has been pointing to the great advantages of Free Trade, and I say we have not had it.

MR. EDWARD COWAN: I am very sorry that there is not some other representative of the free import side who might have contributed to this discussion in a way very much better than I shall be able to do. I said I did not propose to send in my name to speak, but as I have been called upon, and we have heard most of the Protectionist side to-night, I venture to say a few words. At the outset, may I say that I am afraid that the division is too deep-rooted between those who are assembled in this hall to-night for there to be any reasonable hope that the discussion will modify our existing views, or that it will have any useful effect. But we are all agreed, I think, on one thing, and that is, that our industry is sick, and therefore whatever disadvantages there may be in talking of this matter outside, there cannot be any difficulty in facing the problem amongst ourselves. We are, I think, agreed that under such circumstances, it is foolish to stand idle and do nothing. We may count up the achievements of the past, as our friend Mr. Mordey did in some very interesting and useful figures, showing that we are ahead, and well ahead, in respect to the consumption of electricity per inhabitant, and the cheapness of that supply, but the contemplation of that does not alter the fact that notwithstanding the amount of fruit the tree has borne in the past, it has at the present moment a disease at its root. What is that disease? The production of electrical apparatus requires the combination of certain necessary factors of production—labour, capital, enterprise and the ability of the *entrepreneur*—that is the man whose business it is to

put all these different factors of production into combination for the best effect. These elements are all vital in the interests of production, and each factor must receive a sufficient remuneration for its services if that service is to be maintained. Now, is capital receiving to-day in the electrical industry a living wage? Is enterprise receiving a living wage? The answer to both these questions is an emphatic negative. That is the disease the industry is suffering from at the present moment. Every contract given by the L.C.C. or by any of the municipalities or any Corporation in this country, upon terms which do not sufficiently remunerate all the necessary factors of production, is destructive in its effect and is sapping the life blood of the industry. This is no exaggeration; it is a scientific economic truth. Without referring to the cause, we may diagnose the disease as a case of destructive competition. We are met here to-night, all of us conscious of this fact, to confer upon the efficacy of Protection, or the maintenance of the *status quo* in respect to free imports which we have at the present time. Now which of these two methods of conducting our business is likely to cure this disease that we are all agreed upon exists? In my opinion, neither of them will cure it. The disease originated in the environment of free imports, and it will continue its destructive course in that environment. A tariff on electrical imports only would afford relief, of course, but there is not the remotest chance of the Government giving us a tariff upon electrical imports alone. The essential difference between the free importer's conception of the effect of a duty and the Protectionist's is this: the Protectionists believe that the gain to some industries would be an absolute gain. I gather from what Mr. Hirst said that this is his deep conviction, and I don't expect for a moment that anything I can say will alter his view as to that. The free importer does not look upon it in the same way. He believes that the gain is only a differential gain; that the gain to some is accompanied by an equivalent corresponding loss to others—that while you are filling up one hole you are making another. Inasmuch as nearly all the differences between the two views depend upon this root difference, it is quite impossible to refer to the various points that have been raised by the speakers in the short time at my disposal to-night. It must be remembered, when you are discussing the question of Free Trade *versus* Protection, that whenever you make any arbitrary change in the accustomed channels of trade, whether in the direction of Free trade or Protection, you increase unemployment of capital and of labour temporarily when you do so. Even in Germany, the moment Protection was done away with and Free Trade established in its place, Germany would suffer from a prolonged period of unemployment of capital and labour as a consequence, just the same as doing the opposite thing in this country would cause the same effect. Capital and labour are, in a measure, fixed, and cannot follow changes in trade as quickly as they are made. Demand is very mobile, but supply has considerable viscosity. I should like to ask whether it is not possible to bridge this division of view. It is surely worth while to try and see whether we cannot agree upon some compromise which is consistent with each side maintaining its own conception of the resultant effects of duties. There are extremists in every disputed question, and right sometimes lies between these two extremes. Can we find a "centre party" solution? Compromises and conferences are in the air at the present time. I venture to make a suggestion, and it is that we should unite in banishing from our industry the rigid—and here I know Mr. Hirst will agree with me—the rigid application of the doctrine of *laissez faire*. I believe that, in history—particularly in French history—the doctrine of *laissez faire* has fulfilled a very useful purpose, but I hold that it is scientifically an untenable doctrine, and I suppose there is hardly an economist or statesman of any account to-day who gives his adherence to that doctrine. Applied to the electrical industry, it means, let things drift along their own way, and shall we not all be agreed that that spells ultimate disaster? Freedom in internal trade and freedom in international trade are both good things, but it is possible to have too much of a good thing. Competition is an excellent thing, but I think we all admit that the electrical industry is getting a little more than is good for its economy—its organs are getting deranged by an excessive supply of this luxury. The sound and efficient organs are suffering through it along with the unsound, and a large part of the industry is getting into an anæmic condition. Now, if we are agreed upon this, and I think that we are, can we not each go our own way in the matter of tariffs, and unite upon this other ground? We can never have united action without sacrifice of some of our own particular notions, and without union we can do very little. Therefore, I say leave the State alone for the present, and let us voluntarily co-operate for two main objects—first, to eliminate destructive competition, and, secondly, to attain higher economy by the regulation and organisation of production in the same way that the railways did in the very early days of their development, on which same lines the steamship companies have followed. To abolish destructive competition, we do not need assistance of the State, but we do need the co-operation of electricity supply works engineers and their committees and councils, and of consulting engineers as representing the consumers' interest. The support and co-operation of the consumers is, in my mind, essential to success. It must be realised that we are not combining to secure monopolistic profits—if it is once thought that we are doing that then all hopes of doing anything will be gone—but that we are merely seeking to put our house in order for the benefit of those who use electricity and electrical apparatus, as well as for our own benefit.

Mr. G. Harland Bowden: Mr. Chairman, I am very glad to have an opportunity of ranging myself on the side of Mr. Hirst, and thereby ranging myself on the side of the practical, as against mere assumptions. In the short time at one's disposal one cannot answer all the speeches of our Free Trade friends and yet have time to work in one's own point of view. Mr. Kingsbury said he thought that the arguments of the Tariff Reformer are, in many cases, vague and mere assumptions. I think that Mr. Kingsbury's arguments in many cases are very vague and merely assumptions—he has dealt only on the narrow basis of the tradesman, without ever thinking of the workman or the employé. He based his conclusions on very bald arguments, and, I think, Mr. Hirst has proved to us quite conclusively that this country has prospered during the last 60 years in spite of Free Trade. I would like to speak now from quite another standpoint—that is, from the standpoint of the electrical contractor. I would say: give this country a carefully thought out system of scientific tariffs, and you will at once bring into existence several decadent industries giving employment to large numbers of our people, and the electrical industries, whose prosperity we all have at heart, will share in the demand thus created, and will share generally in the prosperity of the country which will certainly result. Our friends who are opposed to us are as sincere as we are in our desire to improve our trade, and the desire for that improvement is the one question to-night on which this assembly is likely to be perfectly unanimous. But there are certain firms represented here which may be described as successful organisations—successful in so far as they obtain a certain percentage of such work as may be going, but can we say that the electrical industry in this country is in a flourishing condition? I think not. I would ask those gentlemen who admit in their turn that there is room for improvement, to put aside their prejudices—and I am afraid I must say that a great part of it is political prejudice—and admit that in countries protected by a tariff, the electrical industries are in a flourishing condition, as a whole, employing a greater number of men who are earning a rate of wage per hour higher than that paid in England. That has been proved as an absolute fact, and a certificate can be found in London signed by the British Minister in Berlin to that effect. There is very little time for me to deal with this question, but my view is in favour of a tariff on imports, called Protection in the title of our debate, and Free Trade, which I will agree with one gentleman who said that it exists only in theory, prevents the British electrical engineer having similar facilities to compete on the Continent as is possessed by Continental firms. By their system of tariffs Continental manufacturers, such as Germany, France and Belgium, are able to keep our manufactures out, whereas if an English electrical engineer had the chance or desire to erect machinery in Germany he would either purchase that machinery in that country or have to pay a heavy import duty into the country. This policy leads to a curtailment of the markets which would otherwise be at our disposal; while, on the other hand, our foreign competitor can come here and do what he likes with our market. There is not only the case of the electrical engineer, but I would refer to the iron and steel industry as being one of the best customers of the electrical engineer. Perhaps there is no other industry which creates such a constant demand for electrical details, and which is so dependent upon the successful working of electrical machinery as the iron and steel process, and yet we find that steel manufactured in Pittsburg and Westphalia is sold in this country at some 20 or 30 per cent. below the price of iron and steel manufactured in this country—in fact, it is often sold at less for the purpose of capturing the British market in the attempt to kill the competition of the British manufacturer. Do we as representatives of the electrical trade consider this a fair way to encourage that large industry to go on to maintain its dealings with us? I am quite certain it is not. I advocate putting a reasonable tariff on imported work—foreign iron and steel—such a duty as would prevent our large railway companies and tramway companies from spending vast sums of money abroad for the purchase of rails. This would encourage the iron and steel industry to employ more of our people, and this would at once create an enormous demand for electrical machinery and details. There is one other case I might refer to, and that is the numerous manufacturing firms who are erecting or who have erected works abroad, and who are bound to erect these works abroad for the purpose of maintaining their position on the other side of the Protection wall. Put a reasonable tariff upon the import of these goods into this country, and you will attract back all those works, and the foreigner, in his turn, would be bound to erect works in this country, which would mean more employment for our own people. I am afraid that, from the Free Trade point of view, this departmental way of considering this great national question lends itself to a petty form of argument. Every electrical engineer knows that, in a large comprehensive engineering scheme, the utility in that scheme can be easily appreciated when you consider it as a whole, but the moment you try to split it up into departments, you cannot possibly see so many advantages; and thus, in the same way, if you reduce this great national question to petty departmental considerations, there is a better chance for the Free Trader to make good certain points. It is necessary to take a wider and a more Imperial view if one wishes to see the advantages which we are likely to obtain generally. The time allowed me has been very short, and I am afraid my few remarks have not done very much to influence those in doubt, but I hope I have been able to convey some reasoning to those in doubt, to see that Protection is likely to mean an increase in the demand for everything in which we deal, and from the sale of which we pay our employés. If I have been able to establish that point in the short time at my disposal, I do most sincerely hope that the possibility of the general prosperity of the country under such conditions will appeal to us, and that we shall see that in common with other industries we shall share in the general prosperity which will result. I was very sorry to hear you say that you are not going to take a vote.

Such a vote would have been very interesting, and I should have liked to have seen it, because I think that many of those who, from time to time at the festive board, represent, or speak for, the electrical industry, but who are, unfortunately, rather wedded to their Free Trade beliefs, while they have a perfect right to say what they like as individuals, they have no right on these occasions to speak for Free Trade as representing this important industry. Therefore, I trust that some opinion will be taken. I hope the result of this debate will be to show to the engineering world at large, that we in common with the vast majority of engineering employés do honestly believe that in Tariff Reform lies our hope for the future, and I close with a quotation which bears on the point—"There is a tide in the affairs of man which taken at the flood leads on to fortune."

Mr. Bennett Fitch: Mr. Chairman and gentlemen, I should just like to say a few words upon the necessity of Tariff Reform, which, to my mind, is the most important and the most urgent national question of the present day. The main argument used by Free Traders is, "See how we have prospered under Free Trade; why should we make a change considering we have done so well, and have increased our wealth more in proportion than any other country." As one who has followed up the question from the early sixties, I desire to point out the cause of our national prosperity at that time, and previously, and for some years later, which was entirely due to our development of engineering and mechanical knowledge, every other country in the world being outsiders in these important points in those days. We, in this country, invented the railway system, and carried it out for many years all over the world. The special advantages we had in addition to engineering and mechanical development, were that we had coal and iron developed far in advance of other countries, and being surrounded by the sea reduced the cost of carriage, and consequently gave us cheaper material than could be obtained in other countries. No other country had coal or iron in the same position that we had, and therefore we made nearly everything for all over the world. I will give you an illustration of what the Germans thought of it in 1849, that is exactly 61 years ago. In Meyer's Encyclopædia, published in Germany in 1849, there appears an article referring to Great Britain from which I will quote. It says:—

"Great Britain outshines all other countries in every branch of human activity, in the raising of raw produce, and in the manufacturing industries. Her rural industries are carried on on a most grandiose scale. . . Great Britain can be called an industrial State only in so far as her agricultural population is inferior in numbers to her industrial population. In no European State have the rural industries made greater progress than in Great Britain. Agriculture and cattle raising show an extraordinary prosperity, and are a model to all countries. Great Britain occupies, not only a commanding position, owing to the perfection at which her agriculture and mining industries have arrived; she is, besides, a model to all nations of the earth with regard to the technical industries, for no country on earth possesses industries of a perfection and size similar to those of Great Britain. There is no branch of industry which has not been cultivated by the British, none in which they have not arrived at the highest perfection. Manufactures of many kinds, such as the wool and metal industries, have been celebrated already for three centuries, but their production has only become unsurpassed in quality and quantity since the middle of the seventeenth century, when the inexhaustible mechanical genius of the British, by the invention of machinery, skilfully utilised the vast powers of Nature which had hitherto lain dormant. England and Scotland are the workshops of the world, which provide not only all the States of Christendom with goods, but which swamp the whole earth with produce of every description. Great wealth favours enterprise in Great Britain. The liberty of the citizens, an advantageous system of patents which may be easily ceded, together with Governmental bounties and grants for the maximum export of manufactured goods, stimulate commercial activity. The use of machinery, which is more developed in Great Britain than in any other country, saves expensive manual labour, and makes it impossible for other nations to compete with that country on equal terms. The position of Great Britain makes a large export to foreign countries absolutely necessary, and Great Britain would rapidly decay and lose her paramountcy if the foreign markets should be closed to her, and if her industries should be stifled by their own productiveness. Therefore, it comes that the political relations of Great Britain with all other countries are based chiefly on commercial considerations."

That is an article written in a German Encyclopædia, every word of which is absolutely true. In those days we made railways for everybody, and we made machinery for every country. I went out as an assistant engineer to Brazil in 1863. There we found gas works, every bit of machinery built by ourselves, every railway and every steam engine was made by ourselves. We had no competition in any shape or form in any part of the world, and to say that because we repealed the Corn Tax of 1s. 6d. per quarter that was the cause of our national prosperity—why there is no argument in it whatever. At that time it did not matter if foreign countries sent us in a few articles, but now they are studying our methods of work and taking our trade away from us. They are getting the mechanical knowledge which in the old days was the whole cause of our prosperity. Our being able to supply cotton and woollen manufactured goods to every country in the world at the cheapest rate was owing to our machinery improvements in the 'forties. There was a great deal of cry about unemployment in those days, but it was because inventions which were brought forward enabled one young girl to carry out the work done by two or three men. The result was that a good many men were thrown out of work, and it was that which caused the Chartist riots in 1848, but those troubles soon passed away, and we began supplying the whole world with cotton and other goods. That was the cause of the riots—because men were thrown out of work owing to the improvement in machinery. If everyone will bear in mind the fact that our national prosperity is not in any way due to Free Trade, but is entirely due to our mechanical knowledge for many years, which the Germans proved in their statement, I think it will cause a considerable revolution on the question, and will cause us to consider whether, after all, Free Trade is the best policy for us now.

Mr. E. Garcke: I do not rise to continue this discussion at this moment, but to ask the chairman whether it would be practicable to put to the meeting the question of whether it would be advantageous to adjourn the discussion to another date. We have listened to several exceedingly interesting speeches, but we have not had the advantage of preparation, and therefore we have not had the benefit of replies to the various statements that have been made by the various speakers. Moreover, it would be very beneficial indeed to have ample time to hear the replies of Mr. Kingsbury and Mr. Hirst, and at this late hour of the evening I venture to say that full justice would not be done to this very important question if we attempted to close the discussion now. At the same time, I would not suggest that the chairman should adjourn this meeting unless there is evidence that there is sufficient interest to justify another meeting. I thought it sufficiently important to make this suggestion.

The Chairman: You have heard Mr. Garcke's suggestion, which seems to me to be a very desirable one. Mr. Kingsbury and Mr. Hirst are both anxious to reply, but as it would be quite impossible to do justice to the subject at this late hour, I should be glad if you would kindly give me your opinion on the question of another meeting.

The Chairman then put the question to the meeting as to an adjournment, and it was carried unanimously. The adjourned discussion will be held at the same place on Monday next, June 6th.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

"Zed" Cartridge Fuses.

As we have pointed out in the past, fuse design in this country has remained in a chaotic state long after fuses have been standardised and brought to a high degree of efficiency on the Continent and in America. This is not due to the high voltage of supply prevailing in this country, for the Continental types of fuse are quite capable of dealing with these satisfactorily.

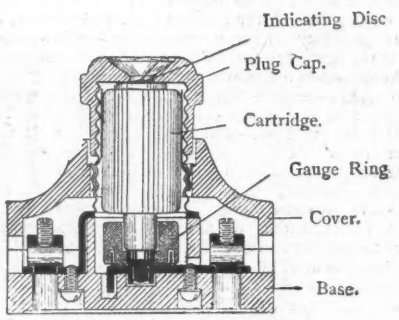


Fig. 1.—Section of "Zed" Fuse.

Fig. 2.—Cartridge Intact.

Fig. 3.—Cartridge Fused.

Fig. 4.—Fuse Fitting with Cap, Type Z II.

With a view to bringing about a very desirable reform in this respect, Messrs. Siemens Bros. Dynamo Works, Ltd., of Caxton House, S.W., have introduced the new "Zed" fuse, which is claimed to possess the qualities of sound design, reliable action and convenience. The essence of the system is standardisation. All the cartridges are exactly alike, and those of different sizes are not interchangeable, nor can the carrying capacity of a fuse be changed by inserting wire of the wrong size or material. There is no danger of shock or fire; the circuit is completely interrupted without flash, and a blown fuse is automatically indicated.

The fittings are made in three types; we give some illustrations of the Z II type, showing its construction and appearance. Fig. 1 is a section of the fitting with cartridge in place, from which it will be seen that the cartridge is held in position by a screwed cap, and fits into a gauge ring, the bore of which fits the lower contact stud of the cartridge, so that a cartridge of larger capacity, with a correspondingly larger stud, cannot be inserted. The cap has a glass window, through which a small coloured disk at the top of the cartridge is visible; when the fuse blows, the disk is set free and projected forward by a small spring, giving a permanent indication of the fact, as shown in figs. 2 and 3.

The external appearance of the fuse is shown in figs. 4 and 5.

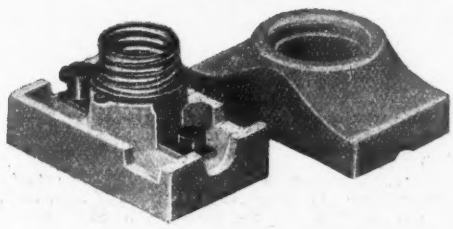


Fig. 5.—Fuse Fitting with Cover Removed.

The fuses are made to blow with an overload of 80 per cent. in the smallest sizes, diminishing to 45 per cent. for the 60-ampere cartridge; up to 15 amperes, the maximum rated voltage is 250 volts, the larger sizes being suitable for 500 volts. They make up very conveniently on distribution boards, and are also supplied in water-tight iron cases.

chart constitutes a record of the ability of each machine attendant, and enables an employer to place his finger, so to speak, on the non-efficient machines or attendants.

Fig. 6 shows a portion of a chart taken from the recording apparatus recently installed at Barn Mills, Carrickfergus, near Belfast. This chart records the fact that No. 16 machine was stopped from 8.24 to 8.54 a.m.—a period of 30 minutes, and that No. 25 machine was stopped from 11.11 to 11.37 a.m.—a period of 26 minutes. The chart also records, as will be observed that

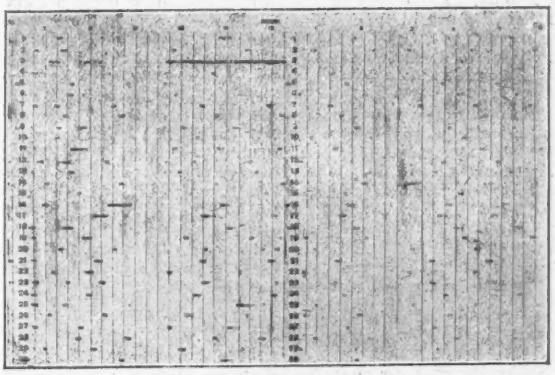


Fig. 6.—Recording Chart.

machine No. 3 was idle for the whole of the forenoon—awaiting a small replacement, but for a much longer period than necessary. An explanation of course would be demanded regarding this unduly long stoppage.

Fig. 7 shows the recorder from which the chart was taken. This actual recorder is of a size suitable for recording the starting and stopping of 30 flax-spinning machines. Thirty small markers will be observed above the drum which carries the chart, and between them and the chart there is an ink ribbon. Each of the markers is connected to one of the textile machines by a wire terminating in

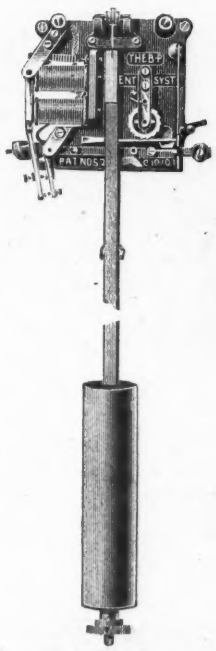


Fig. 9.—Transmitter.

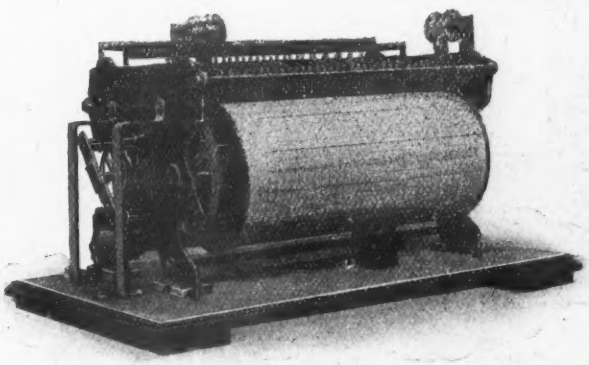


Fig. 7.—Coates Recorder.

Fig. 8.—Contact Device.

Fig. 10.—Impulse Dial.

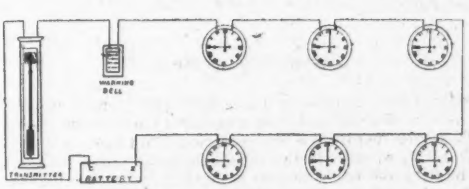


Fig. 11.—Diagram of Circuit.

Electrical Stop and Start Recording Apparatus.

Next in importance to the electrical driving of textile machines comes the pressing question of output—that is to say, whether the machines are kept constantly running by the employés. It is well known that a considerable leakage takes place in this direction, but the identification of the offending machines—or, rather, the persons responsible for the continuous running of the machines—has been neglected.

Messrs. Wm. Coates & Son, Ltd., of Belfast, have given considerable attention to the subject, and are now installing apparatus which will record on a chart (attached to a suitable machine, fixed preferably in the office) the number of half-minutes per day each machine has been stopped, and the times of such stoppages. The value of such an arrangement cannot be over-estimated, as the

the contact device enclosed in an iron tamper-proof box as shown at fig. 8. Each of these boxes is mechanically connected to one of the machines and is arranged so that as long as the machine is running, the contact is broken, but when it is stopped, the contact is closed; but no current flows until a relay, which is put in the common return and serves for the whole of the machines, closes its contact for about $\frac{1}{10}$th of a second at half-minute intervals in obedience to an electric impulse clock described below, which also operates the drum of the recorder. When at any half-minute the relay finds a circuit closed by any of the machines, a current flows through the magnet of the marker and the tell-tale record is made. This record is repeated at each half-minute so long as such machine is stopped. Each day the readings of the charts are entered in a specially-ruled log book, and the total weekly stoppages are made up every Monday.

The drum which carries the chart is electrically driven at a uniform rate, which is just sufficient to make each of the half-minute marks separate and distinct.

The electric impulse clock system employed to operate the recorder and relay is known as the BIP, and consists of a master clock or transmitter, a Leclanché battery, and a number of impulse clocks or other half-minute impulse instruments, all arranged in a simple series circuit.

Fig. 9 shows the mechanism of the transmitter, fig. 10 that of an impulse dial. The transmitter is the timekeeper of the system, and its duty is to send electrical impulses through the circuit and to operate any mechanism included in such circuit with absolute uniformity. The circuit of the installation under consideration comprises a number of impulse clocks which give uniform time throughout the mills. An impulse movement, as shown at fig. 10, is employed to drive the drum of the recorder, and also the relay which actuates the markers. Besides providing a convenient and efficient means of driving the drum, the half-minute electric impulse provides just the duration required for operating the markers without producing a drag on the ink ribbon, which would blur the record. A complete impulse time circuit is shown diagrammatically in fig. 11, the recorder and marking relay being added to the circuit at any convenient position. The warning bell shown in the diagrams performs the useful duty of giving timely warning of the weakening of the battery, thus preventing stoppage of the system. It also indicates whether or not sufficient current is being provided for efficient working. This system has been giving satisfactory results for some months past.

Economic Electric Cooker.

Following on their previous efforts to cheapen and simplify electrical cooking apparatus, MESSRS. F. A. WILKINSON AND PARTNERS, LTD., of Harpenden, Herts, are introducing the device here illustrated. It consists of a little oven, 12 × 12 × 14 in. inside, with one of the firm's patent heating elements mounted on

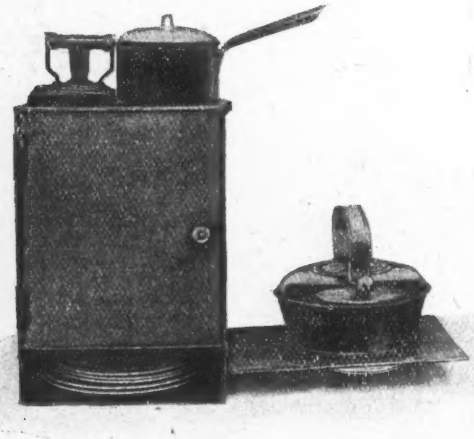


FIG. 12.—ECONOMIC ELECTRIC COOKER.

one side. The latter is carried on hinges, so that it can be lowered into the position shown in the figure, for boiling, frying, &c., while in its ordinary position it heats the oven. The power consumed is 1,000 watts, and the cost of the apparatus is very low.

Messrs. Siemens Bros. Dynamo Works, Ltd., are selling agents for the component parts of the Economic electric stoves, from which the plate and coil used in the cooker are derived.

A New Trolley Head.

Many inventions have been made with the idea of producing a trolley head which will fulfil three cardinal requirements:—

(*a*) To follow readily the wanderings of the trolley wire.

(*b*) To refuse to catch in the overhead construction if the wheel should be de-wired while the car is moving.

(*c*) To allow the conductor to replace the wheel on the wire without difficulty.

Some of the inventions have succeeded in one or two of these ordeals, but few, if any, can be said to be perfect in every particular.

MR. DUDGEON has designed a trolley head which seems to satisfy all needs, if we may judge from the drawings and descriptions which have been submitted to us, and from the more valuable evidence of Mr. Hill (now general manager of the Bournemouth Tramways), who has authorised the statement that Mr. Dudgeon's trolley head gave entire satisfaction upon one of the most difficult routes in Birmingham.

Our illustrations show that the head is self-clearing, as there is no projection or gap to catch the smallest wire which would be used upon a tramway. The head hinges rather than swivels, and is intended for use upon tramways where the trolley wire does not depart more than 11 ft. from the track centre. The hinged head was invented independently by Mr. Dudgeon some years ago, but a search brought to light a prior patent for an identical design, which, so far as we know, was never put to practical use, although it seems well adapted for it. Probably there was a difficulty in getting the wheel on to the wire, for this design included a pair of aligning springs, one on each side of the head.

Springs have been used for this purpose by several inventors, but they always suffered from the fault of being in action all the time.

Mr. Dudgeon makes use of a spiral spring, but merely to balance the weight of the trolley rope, plus a pull up to about 18 lb. By

FIG. 13.—DUDGEON TROLLEY HEAD.

means of a crank forked at the end, which is made to engage with the trolley head when alignment is necessary, and attached to the trolley rope at the other end, the head can be held rigidly while the conductor is pulling the rope, but regains entire freedom to hinge on its spindle directly the trolley rope is released. Nothing but the slight friction of the spindle in the socket, and any flange action which there may be between the wire and the wheel, is tending to de-wire the wheel, and in the latter respect it has a great advantage over the fixed head, which is used so largely upon so-called centre-running systems.

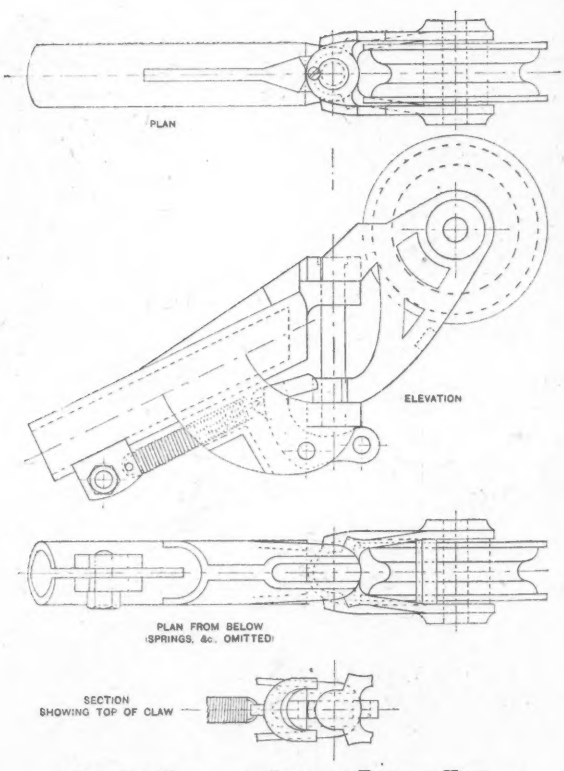


FIG. 14.—DETAILS OF DUDGEON TROLLEY HEAD.

This design puts no difficulty in the way of the trolley rope being held taut while the wheel is passing under frogs and crossings, and in the event of the spring being thrown out of action by breakage or any other cause, the head would continue to hinge, but would do this against the few ounces weight of the trolley rope.

Our illustration is of the first pattern made, but this has been altered in the later model by bringing the hinging axis inside the groove of the wheel, or about 1¾ in. from the centre.

The complete head weighs 6 lb. 10 oz., which is remarkably light for this type.

The "Barlock" Cap.

Electric candles, when held in short holders, are apt to assume a position slightly out of the vertical, which, while it may intensify the resemblance to the old-fashioned wax candle, by no means improves their appearance. To remedy this defect, the Lux Candle Co., Ltd., of 240, High Holborn, W.C., have introduced a

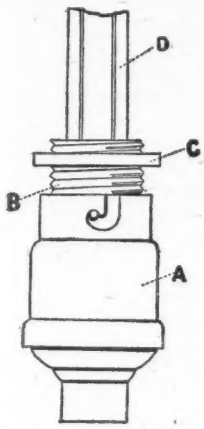


Fig. 15.

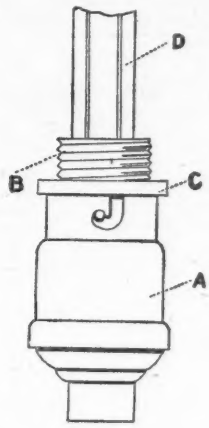


Fig. 16.

Lux "Barlock" Cap.

simple device, which is illustrated herewith. It consists of a collar C screwed on the cap B, fig. 15; after the Lux lamp D is fitted into the holder A, the collar is screwed down tight on the holder, firmly clamping the lamp in a perfectly upright position, as in fig. 16. Patent rights are being obtained for the device, which appears to be very effectual and inexpensive.

Aids to Draughtsmen.

Messrs. W. J. Brooks & Co., of Letchworth, Herts, who have introduced several ingenious time-savers for the drawing office, have lately brought out two useful devices of the same nature. One is a patent T-square lock, which can easily be attached to any ordinary square, and enables the user to lock the latter in any position on an inclined or vertical drawing board, leaving both hands free for other purposes, while nevertheless the square can be moved with the same freedom as an ordinary T-square.

The other device is the "Pinro," a patented steel strip provided with pins at intervals of about 4 in., and made in lengths up to 12 ft. A strip of this is used along each edge—or two opposite edges—of the drawing paper, securely fastening the latter in position, with less obstruction to the movement of the T-square than pins offer, and greater convenience.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Proposed New Japanese Tariff.

(*Concluded from page 887.*)

	Present Tariff. Yens per 100 kin.	Proposed Tariff. Yens per 100 kin.
Railway freight wagons; electric, horse and other tramway cars ...	20 % ad val.	—
Parts of locomotives, tenders and other vehicles, running on rails, not otherwise provided for:		
(1) Wheels and axles:		Per 100 kin.
(A) For locomotives	(See below.)	2·40
(B) Other		1·50
(2) Tires		1·00
(3) Buffers and springs		3·00
(4) Controllers for electric cars ...		8·00
(5) Other		20 % ad val.
Parts of locomotives and locomotive tenders, and parts of railway carriages for passengers ...	5 % ad val.	—
Parts of freight wagons:		
Wheels and tires	1·51	—
Tires...	1·32	—
Buffers	2·33	—
Springs	2·00	—
All other	20 % ad val.	—
Parts of electric, horse and other tramway cars	20 % ad val.	—
Steam boilers...	15 % ad val.	3·70
Parts and accessories of steam boilers not otherwise provided for:		
(1) Mechanical stokers	15 % ad val.	4·25
(2) Flanged boiler plates, and corrugated boiler-furnace tubes		2·45
(3) Other		25 % ad val.
Fuel economisers	15 % ad val.	1·60
Feed water-heaters		7·10
Electric locomotives...	5 % ad val.	9·20
Steam turbines	15 % ad val.	20 % ad val.
Steam engines not otherwise provided for:		
(1) Each weighing not more than 250 kg....	15 % ad val.	16
(2) Each weighing not more than 1,000 kg.		9
(3) Each weighing not more than 5,000 kg.		8
(4) Each weighing not more than 50,000 kg.		6
(5) Each weighing not more than 100,000 kg.		4·40
(6) Other		4
Gas engines, petroleum engines and hot-air engines:		
(1) Each weighing not more than 100 kg....	15 % ad val.	30
(2) Each weighing not more than 250 kg....		20
(3) Each weighing not more than 1,000 kg.		9
(4) Each weighing not more than 2,500 kg.		7
(5) Other		5
Water turbines and Pelton wheels:		
(1) Each weighing not more than 500 kg....	15 % ad val.	26
(2) Each weighing not more than 1,000 kg.		9
(3) Each weighing not more than 5,000 kg.		8
(4) Each weighing not more than 10,000 kg.		7
(5) Other		5·40
Dynamos, electric motors, transformers, converters and armatures:		
(1) Each weighing not more than 25 kg.	15 % ad val.	26
(2) Each weighing not more than 50 kg.		16
(3) Each weighing not more than 100 kg....		14
(4) Each weighing not more than 250 kg....		13
(5) Each weighing not more than 500 kg....		12
(6) Each weighing not more than 1,000 kg.		10
(7) Each weighing not more than 5,000 kg.		9
(8) Other		7
Dynamos combined with motive machinery:		
(1) Combined with steam turbines	15 % ad val.	20 % ad val.
(2) Combined with steam engines:		
(A) Each weighing not more than 250 kg.	15 % ad val.	15·20
(B) Each weighing not more than 500 kg.		10·60
(C) Each weighing not more than 1,000 kg.		10·20
(D) Each weighing not more than 2,500 kg.		8·80
(E) Each weighing not more than 5,000 kg.		8·40
(F) Each weighing not more than 10,000 kg.		7·20
(G) Each weighing not more than 50,000 kg.		6·40
(H) Each weighing not more than 100,000 kg.		5·40
(I) Other		5·20
(3) Combined with gas engines, petroleum engines or hot-air engines:		
(A) Each weighing not more than 250 kg.	15 % ad val.	17·60
(B) Each not weighing more than 500 kg.		10·60
(C) Each weighing not more than 1,000 kg.		10·20
(D) Each weighing not more than 2,500 kg.		8·20
(E) Each weighing not more than 5,000 kg.		6·60
(F) Other		5·80
(4) Other	15 % ad val.	20 % ad val.

	Present Tariff. Yens per 100 kin.	Proposed Tariff. Yens per 100 kin.
Motive machinery, not otherwise provided for	15 % ad val.	20 % ad val.
Cranes:		
(1) Combined with motive machinery	15 % ad val	4·20
(2) Other...		3·90
Capstans, winches, windlasses and other winding machines, not otherwise provided for:		
(1) Combined with motive machinery:		
(A) Each weighing not more than 1,000 kg.	15 % ad val.	8·00
(B) Each weighing not more than 5,000 kg.		6·00
(C) Other		5·00
(2) Other		3·85
Power hammers, other than steam-operated	15 % ad val.	20 % ad val.
Filaments for incandescent electric lamps	30 % ad val.	20 % ad val.
Carbon for electrical use, not specified	6·86	8·30
Incandescent electric lamps:		
With carbon filaments:		
Not exceeding 32 C.P. (per 100 pieces)	5·80	8·90
Other (per 100 pieces) ...	10·20	21
Other (per 100 pieces)	5·80 / 10·20	40 % ad val.
Sockets and shade-holders	30 % ad val.	64·60
Lamps and parts thereof not specially mentioned in the Tariff	30 % ad val.	40 % ad val.

NEW PATENTS APPLIED FOR, 1910.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & CO., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

12,077. "Improvements in or relating to telephone systems," G. M. BIRAM. May 17th.

12,089. "Improvement in cord-grip lampholders and like electric fittings." S. JOHNSTON. May 17th.

12,190. "Means for and method for limiting the current on a short circuit." A. M. TAYLOR. May 17th.

12,122. "Arrangements for localising faults on high-tension alternating-current circuits." A. M. TAYLOR. May 17th.

12,133. "Improvements in sparking plugs." E. KUHN. May 17th. (Complete.)

12,149. "Improvements in arc lamps." A. BISSON and G. BERGES. May 17th. (Complete.)

12,150. "Improvements in starting devices for internal combustion engines." P. M. JUSTICE. (J. M. Dupont, A. Dupont and P. W. Hodgkinson, United States.) (Complete.)

12,174. "Improvements in dynamo-electric machinery." A. H. MIDGLEY and C. A. VANDERVELL. (Application for Patent of Addition to No. 16,447, 1909.) May 17th.

12,180. "Switch-throwing mechanism." H. SHEMWELL. (Date applied for under Sec. 91 of the Act, May 29th, 1909, being date of application in United States.) May 17th. (Complete.)

12,184. "Electric switch." A. H. JOHNSON. May 18th.

12,192. "Attachment to or improvement in electrical lampholders and shade carriers." H. J. BENTLEY. May 18th.

12,213. "Electric corset." C. M. VANE. May 18th.

12,214. "Improvements in electric induction smelting furnaces." A. HIORTH. (Date applied for under Sec. 91 of the Act, May 22nd, 1909, being date of application in Norway.) May 18th. (Complete.)

12,248. "Improvements relating to selectors for automatic telephone exchange systems." W. P. THOMPSON. (Deutsche Telephonwerke G.m.b.H., Germany.) May 18th. (Complete.)

12,259. "Improvements in and relating to electromagnetic clutches." E. C. H. T. LUGARD. May 18th. (Complete.)

12,261. "Improvements relating to electric generating systems." G. LAYTON. May 18th.

12,265. "Improvements in or relating to electric motor control systems." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) May 18th.

12,269. "Improvements in electrical switchgear." A. M. TAYLOR. May 18th.

12,299. "Improvements in and relating to dynamo-electric systems and the like." M. B. FIELD and FERRANTI, LTD. May 19th.

12,300. "Improvements in and relating to dynamo-electric systems and the like." M. B. FIELD and FERRANTI, LTD. May 19th.

12,316. "Improvements in time-signalling apparatus." W. RAUSCH. May 19th. (Comp'ete.)

12,322. "Improvements in electrical heating appliances." L. NEWITT and F. P. FLETCHER. May 19th.

12,342. "Improvements in electric insulators." BULLERS, LTD., and G. V. TWISS. May 19th.

12,347. "Improved electric switch." L. B. DE LAITTE and SAFETY LIGHT, LTD. May 19th.

12,355. "Improvements in or relating to electric transformers." A. F. BERRY. May 19th.

12,357. "Low-tension make-and-break electric safety lamp lighter." H. WILSON. May 21st.

12,368. "Electric safety lamp." P. L. TRIN. May 21st. (Complete.)

12,408. "Improvements in and relating to relays for telephone circuits." W. O. G. DROOP. (Date applied for under Sec. 91 of the Act, May 21st, 1909, being date of application in Belgium.) May 21st. (Complete.)

12,427. "Improvements in or relating to switch apparatus suitable for use in electrical distribution systems." F. E. BERRY. May 21st.

12,428. "Improvements in or relating to electric resistances." CLARKE, CHAPMAN & CO., LTD., and R. C. HARRIS. May 21st.

12,430. "Means for supplying the electrodes in reverberatory electric furnaces." AKTIEBOLAGET ELEKTROMETALL. (Date applied for under Sec. 91 of the Act, May 21st, 1909, being date of application in Sweden.) May 21st. Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & CO., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1908.

MODE OF AND MEANS FOR PURIFYING OILY OR GREASY WATER OR CONDENSED STEAM BY ELECTRICITY. R. B. Perrett and E. Perrett. 26,477. December 7th. (Post-dated June 7th, 1909.)

1909.

POLYPHASE COMMUTATOR DYNAMO-ELECTRIC MACHINES. Siemens Bros. Dynamo Works. (Siemens-Schuckertwerke Ges.) 21,640. September 21st.

DEVICES FOR THE AUTOMATIC COUNTING AND RECORDING OF TELEPHONE CALLS. J. Kiessler. 23,742. October 16th.

END CONNECTIONS OF THE ROTOR AND STATOR BARS OF DYNAMO-ELECTRIC MACHINES. Brush Electrical Engineering Co. and Porter. 27,641. November 27th.

ELECTRO-MECHANICAL APPARATUS FOR THE TRANSMISSION, RECEPTION AND INDICATION OF PRECONCERTED SIGNALS. A. E. Vickery. 1,948. January 27th. (Post-dated July 26th, 1909.)

DYNAMO-ELECTRIC MACHINES. Allgemeine Elektricitäts Ges. 6,312. March 16th. (Date applied for under International Convention, March 17th, 1908.)

ELECTRIC ACCUMULATORS OR STORAGE BATTERIES. G. O'Kill. 8,875. April 14th.

SEMI-AUTOMATIC TELEPHONE EXCHANGES. Siemens Bros. & Co. (Siemens and Halske Akt.-Ges.) 9,055. April 16th.

ELECTRIC CONTROLLERS. R. V. R. Sill. 9,349. April 20th.

ELECTROLYTIC CELLS. R. W. Williams, J. R. Bradley and K. Bradley. 9,796. April 24th.

PROTECTION OF HIGH-TENSION DIRECT-CURRENT MOTORS IN SERIES. T. von Zweigbergk. 11,304. May 12th.

CARBON ELECTRODES FOR GALVANIC ELEMENTS. S. Benko. 12,677. May 28th.

MANHOLE COVERS FOR SEWERS, ELECTRICAL CONDUITS AND SIMILAR PURPOSES. R. Ames. 14,898. June 26th.

ELECTRIC REFLECTOR LAMPS. C. Regnart. 15,115. June 28th.

METHOD OF ELIMINATING OR REDUCING ELECTROSTATIC AND ELECTROMAGNETIC INDUCTION BETWEEN CONTACT WIRES OF ELECTRIC TRACTION SYSTEMS AND ADJACENT TELEGRAPH AND/OR TELEPHONE CIRCUITS. J. Sayers. 15,158. June 29th.

SWITCH MECHANISM FOR SMALL ELECTRIC LIGHTING INSTALLATIONS. C. A. Vandervell and A. H. Midgley. 18,665. August 13th.

DEVICE FOR AUTOMATICALLY ADJUSTING THE TIME OF IGNITION IN INTERNAL-COMBUSTION ENGINES. A. G. Bloxam. (Firm of Robert Bosch.) 19,806. August 21st.

MOUTHPIECES FOR TELEPHONE TRANSMITTERS. M. S. Hufschmidt and V. F. Wagner. 23,269. October 12th. (Date applied for under International Convention, November 10th, 1908.)

ELECTRIC FUSES FOR BLASTING. J. Gillies and C. D. McPhee. 23,302. October 12th.

ELECTRIC GAS IGNITER. F. Deimel. 24,500. October 25th.

WIRELESS TELEGRAPHY OR WIRELESS TELEPHONY. Compagnie Générale Radiotelegraphique Carpentier, Gaiffe, Rochefort. 25,542. November 5th. (Date applied for under International Convention, November 13th, 1908.)

DRIVING OF DYNAMO-ELECTRIC MACHINES FOR MOTOR, CYCLE AND LIKE LAMPS. A. Thomsen and N. P. Christensen. 27,810. November 29th. (Application for Patent of Addition to No. 5,972 of 1908.)

APPARATUS FOR THE ELECTRIC LIGHTING, HEATING, COOLING AND VENTILATING OF RAILWAY CARRIAGES AND OTHER VEHICLES. J. Stone & Co. and A. H. Darker. 7,425. May 27th.

ELECTRICALLY-PROPELLED VEHICLE BRAKES. J. F. Simpson. 9,404. April 21st.

ELECTRIC CONTROLLER CONTACT FINGERS. F. Jackson and W. L. Hurst. 9,829. April 26th.

DRIVING OF AUTOMATIC TELEGRAPH TRANSMITTERS OR RECEIVERS. P. Mulligan. 10,223. April 30th.

VAPOUR ELECTRIC APPARATUS AND METHODS OF OPERATING THE SAME. Brush Electrical Engineering Co. and C. O. Bastian. 10,409. May 1st.

COMMUTATORS OF DYNAMO-ELECTRIC MACHINES. Hon. C. A. Parsons, A. H. Law and J. P. Stockbridge. 10,588. May 4th.

ELECTRIC CURRENT GENERATORS ACTUATED BY MOVEMENTS OF THE BODY. J. P. Dyhr. 11,107. May 11th.

ELECTRIC ARC LAMPS. E. R. Grote. 11,282. May 12th.

ELECTRIC DISTRIBUTION SYSTEMS. British Thomson-Houston Co. and Wedmore. 11,285. May 12th. (Cognate application, No. 12,048 of 1909.)

ELECTRIC SWITCH-OPERATING MECHANISM. Electric Control, Ltd., C. Macmillan and W. P. Dryer. 12,395. May 26th.

TROLLEY HEADS FOR ELECTRICAL TRAMCARS. W. L. Smith and W. Watson. 12,607. May 28th.

ELECTRIC LOCKS. J. Zabski. 14,164. June 16th.

DEVICE FOR CONTROLLING ELECTRIC ARC LAMP CARBONS. H. D. Weaver. 14,674. June 23rd.

ELECTRIC ARC LAMPS. P. A. Messenie and W. E. Slaughter. 16,292. July 13th.

1910.

TELEPHONE EXCHANGES. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 3,400. February 11th.

INSULATED SHAFT COUPLINGS. J. R. Grundy. 4,093. February 18th. (Date applied for under International Convention, March 29th, 1909.)

ELECTRO-THERAPEUTIC APPARATUS. M. G. McElhinney. 1,823. January 25th.

APPARATUS FOR THE ELECTRIC LIGHTING, HEATING, COOLING AND VENTILATING OF RAILWAY CARRIAGES AND OTHER VEHICLES. J. Stone & Co. and A. H. Darker. 7,468 and 7,470. March 24th. (Date applied for under Rule 13, March 27th, 1909.)

ELECTRIC LIGHTING, HEATING, COOLING AND VENTILATING SYSTEMS FOR RAILWAY CARRIAGES AND OTHER VEHICLES. 7,471. Particulars same as No. 7,468.